Modern Refrigeration & Air Control

Vol. 62 No. 734 MAY, 1959 Price 2s. 6d. monthly

REFRIGERATION FITTINGS—

angle valves dehydrators receivers unions
compressor valves filters sight glasses
flare nuts elbows tees rupturable discs

manufactured by

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"HOOVER," "CROMPTON" and "DELCO" MOTORS
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A comprehensive supply of Equipment

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Q
A
When is a door not a door
The "MINIVEIL" air curtain permits the cold store door to remain open for prolonged periods, giving completely free passage for men and goods, with a negligible rise in store temperature. This is achieved by a controlled curtain of air over the outside of the door-opening the whole time the insulated door is open.
No longer need you bother about the constant opening and closing of cold-room doors or the proper operating of air locks by the coldroom staff. You can rely on the protection afforded by the curtain of air provided by a "MINIVEIL" unit.
When it's a
MINIVEIL
AIR CURTAIN
Let us help you
TO PUT SOME LIGHT ON THE PROBLEMS OF
WET INSULATION
The Minikay System keeps new insulation permanently dry and dries out existing wet insulation.
The Minikay System eliminates the heavy cost of re-insulation.
The Minikay System extends the life of your cold store to that of normal buildings.
Cold Storage insulation is extremely valuable—protect it with Minikay.
MINIVEIL
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DEHYDRATION
For Efficient COLD STORAGE Operation
MINIKAY LIMITED
39 NEW BROAD STREET, LONDON, E.C.2
Telephone London Wall 6581

Leconomy - for Summer profits

It's Time To Sell This NEW Lec Counter Server

ONLY

£98 Retail including installation and minimum service fee of £3.0.0.

or on the easiest of deferred terms

THE C.D.6. with its wide-view selling area, is designed to appeal to all go-ahead retailers of frozen foods.

Powered by the murmur-quiet economical Silcmetic refrigeration unit, it will give years of trouble-free service. Both the cabinet (1 year) and the unit (5 years) are fully guaranteed. The counter-display is beautifully finished in gleaming stove enamel, making it well-nigh irresistible to customers.

For its size—only 14" x 72" x 27" — it is the most efficient point-of-sale refrigerated cabinet on the market. Make sure you are holding sufficient stocks, and remember, there are special terms for bulk orders.

★ **Lec have VACANCIES FOR ENGINEERS. If you have a genuine interest in Refrigeration Engineering development, and a sound technical background, we will be pleased to discuss the possibility of your joining the Company.**

Send this off today

To **Lec REFRIGERATION LTD., BOGNOR REGIS, SUSSEX**

Please send me full details of the Lec C.D.6. Counter Server and other Lec commercial refrigeration equipment.

Name .....

Address .....

MR7.....

Lec

Luxury refrigeration at lowest-ever cost

Lec REFRIGERATION LTD. : BOGNOR REGIS : SUSSEX : Tel.: 2201 ; London Showrooms: 217 REGENT ST. : W.1 : We supply only to trade

OUR VALVES HAVE MANY FACES

Did you know that each one of our automatic control valves has a personality of its own? Take 'Safety Cut-out', for instance. Now, he's a careful type who shuts up like a clam whenever his electrical circuit is disturbed and flatly refuses to allow either liquids or gases to pass. Or there's 'Balanced 3-way'. This fellow is a leader and controls other chaps doing all the hard work—Pneumatic and Hydraulic cylinders for example. We have over 100 different 'types' of valves for every kind of automatic or remote control system involving water, steam, coal gas, oil, air and many other industrial liquids and gases. They don't use glands, stuffing-boxes or driving shafts and, what's more, they have a reputation for hard work, long life and the utmost reliability. Full technical details of this family of automatic control valves are contained in our new brochure No. 57. Why not write *NOW* for your copy?

Well over 100 of them, in fact. A 'type' to suit every requirement.

MAGNETIC VALVES ARE USED EXTENSIVELY IN

AIR CONDITIONING	LAUNDRY PLANT
AUTOMATIC STOKERS	MACHINE TOOLS
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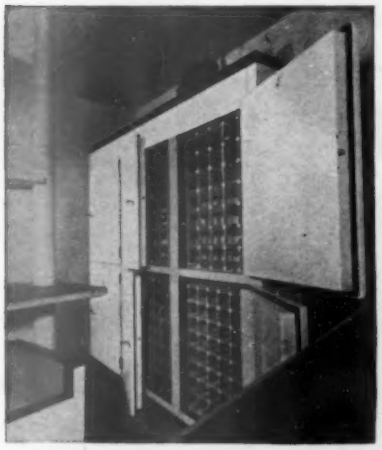
M.V.2

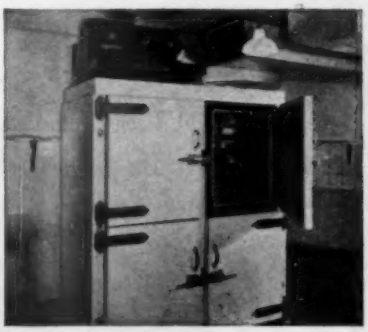
How FRIGIDAIRE helped make the Hippodrome...

Frigidaire has played an important role in converting the London Hippodrome *from top to bottom* into an up-to-date theatre-restaurant . . . "The Talk of the Town!" The extensive modern refrigeration equipment supplied incorporates no less than seventeen Frigidaire condensing units.



FRIGIDAIRE FOR THE BALCONY!

The kitchen on this floor is very fully equipped with special Frigidaire service cabinets designed for quicker, more efficient service. In the balcony bar, there is a special wine-cooling cabinet and also a standard beverage cooler.



FRIGIDAIRE ON THE GROUND FLOOR!

The kitchen on this floor—for serving diners on ground floor level—contains two standard upright service cabinets, besides a stainless steel cabinet with service compartments for cooling salads, hors d'oeuvres, smoked salmon, ice cream, etc. The bar on this floor, too, is equipped with a special wine-cooling cabinet.

FRIGIDAIRE FOR THE BASEMENT!

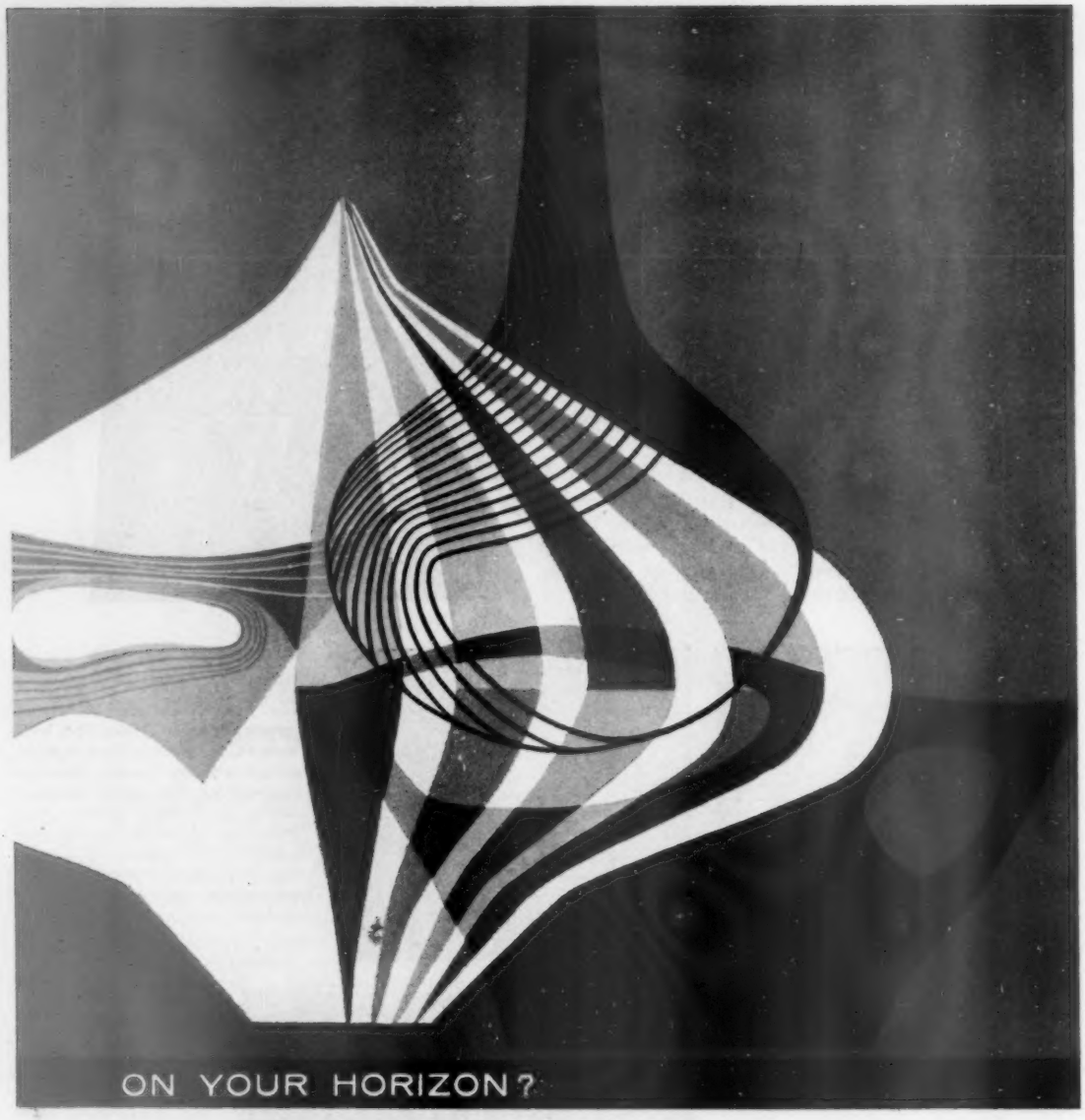
Here there are two meat cold rooms of 650 and 370 cu. ft. Adjoining these, there is a 20 cu. ft. fish cabinet and a 45 cu. ft. low-temperature cabinet for confectionery products and ice cream.

FRIGIDAIRE FOR YOU! Let Frigidaire equipment make *your* business the talk of the town. Call your Frigidaire Distributor or write for details *today*.

FRIGIDAIRE means business—for you!

Regd. T.M.

FRIGIDAIRE DIVISION OF GENERAL MOTORS LIMITED, STAG LANE, KINGSBURY, LONDON, N.W.9



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At this moment, on a drawing board somewhere, is a design which could mean an entirely new product. It could be a product for either light or heavy industry: for instance, toys or electronics, household appliances or chemicals. But whatever the field, when the time comes for bulk manufacture, there are powerful reasons—mechanical, chemical, dielectric and economic—for believing that the material chosen will be high impact polystyrene.

When that happens it will not be just happy chance if the selected brand of polystyrene is Iridon. Iridon Limited have the resources and the experience to meet the demands of every new development the moment it becomes a mass market proposition. Iridon Limited are constantly perfecting new techniques, new processes; constantly exploring the immense possibilities in plastics — always with the aim of fitting them for the ever-changing pattern of industry.

If your particular pattern needs the best in thermoplastic sheeting to add to its competetive potential, you could profitably contact Iridon.

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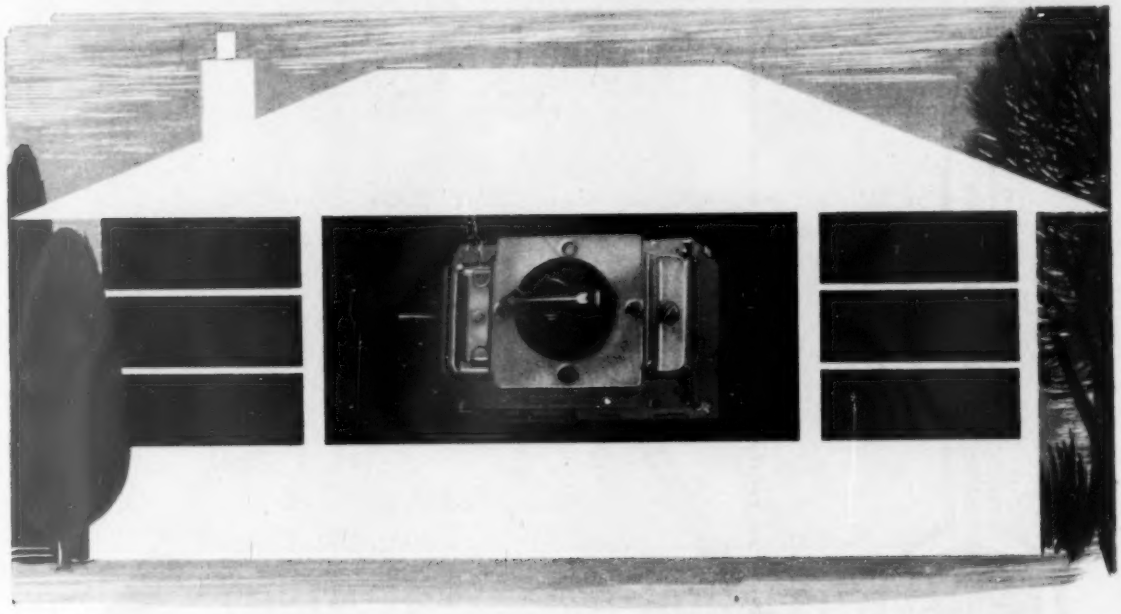
Member of the cp Group—one of the world's major manufacturers of plastics sheet and film.

IT'S A GOOD OUTLOOK WHEN AIR-CONDITIONING IS RANCO CONTROLLED



C17 control for air conditioners

Amongst a wide range of Ranco Controls for Air Conditioning is the C.17 series – specially developed for window type Air Conditioners which incorporate a Heat Pump. This instrument provides the facility of automatic change-over from heating to cooling and cooling to heating as the external temperature changes.

As with all Ranco Controls, the C.17 series can be provided with modifications that vastly increase its range of application. For example, the C.17 permits automatic heating-cooling operation when used to control either a compressor and solenoid-operated reversing valve or a compressor and resistance heater. Similarly, the new Ranco Control provides two-stage cooling when used in combination with two compressors. Simplifying the operation of a very wide range of equipments, the C.17 may very well be just the versatile control for which you are looking. *You can confirm this by writing for technical information and specifications.*

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Cables : Rancostat, Glasgow, Telex
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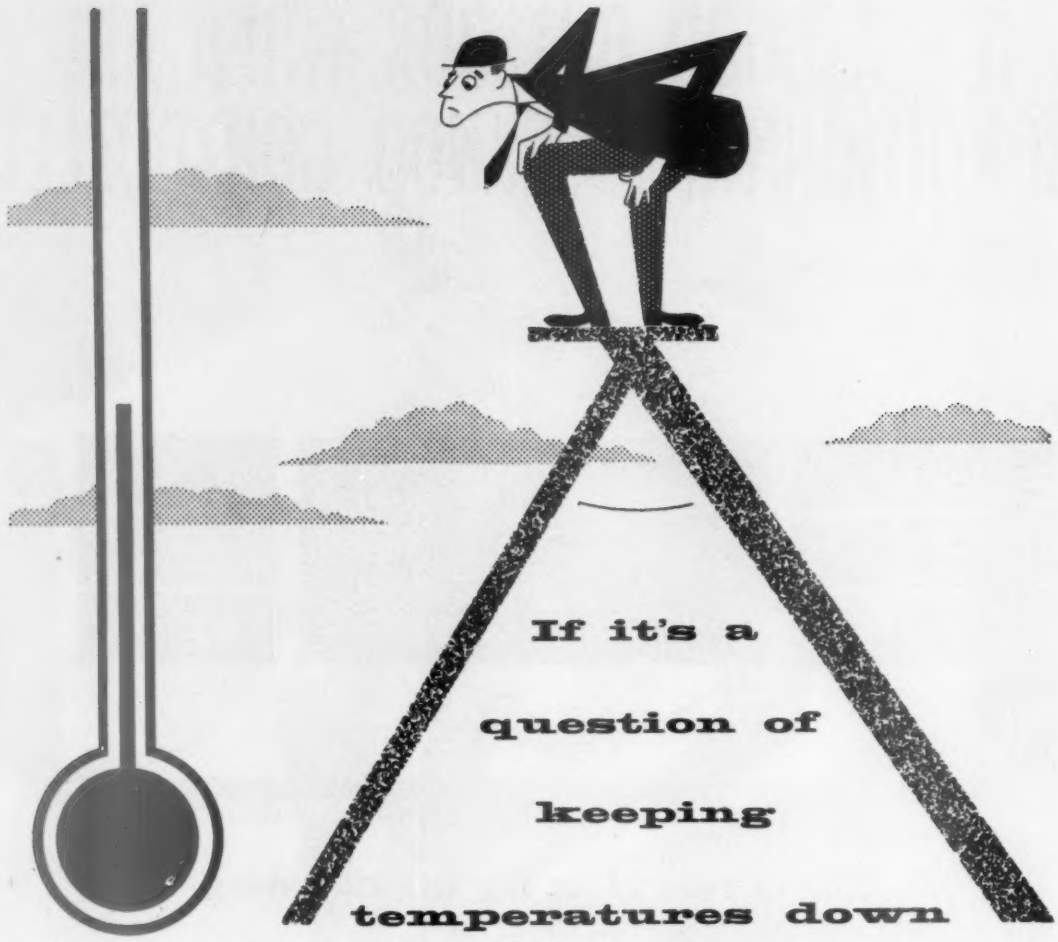
BIGGEST NAME IN SMALL CONTROLS FOR REFRIGERATION, HEATING AND AIR CONDITIONING



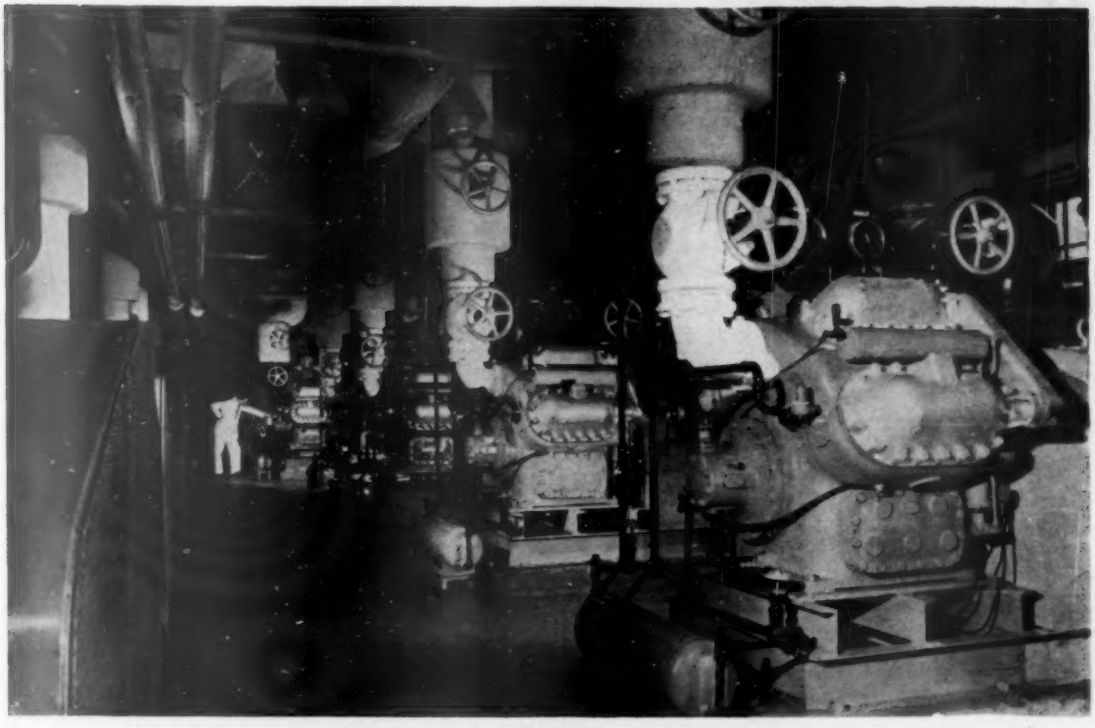
Whenever low temperature insulation is concerned, Newalls are the people to look to. They have a background of over 50 years experience in all kinds of contracts—in cold stores, in cargo and passenger ships, in breweries and creameries — in fact wherever there are refrigerated spaces.
Newalls supply *and* apply low-temperature insulation materials and their service is available through each of eight depots situated throughout the United Kingdom. When the specification calls for a first class job, call in Newalls.

Newalls

LOW-TEMPERATURE INSULATION

NEWALLS INSULATION CO. LTD. *Head Office*: WASHINGTON, CO. DURHAM.
A member of the TURNER & NEWALL ORGANISATION
Offices and Depots at LONDON, GLASGOW, MANCHESTER, NEWCASTLE UPON TYNE, BIRMINGHAM, BELFAST, BRISTOL & CARDIFF. *Agents and Vendors in most markets abroad.*

REFRIGERATION TO MEET THE NEEDS OF MODERN INDUSTRY



THREE THOUSAND HORSEPOWER AT THE NEW LYONS MAID FACTORY, GREENFORD

MAIN REFRIGERATION CONTRACTORS:

YORK SHIPLEY LTD.

No less than 3,000 horsepower is employed in the main engine room at the new LYONS MAID factory at Bridge Park, Greenford, one of the biggest plants in the country devoted entirely to the manufacture of ice cream.

Refrigeration is provided by five eight cylinder V/W compressors, five Vertical Single Acting Booster compressors and two Rotary Booster compressors, with provision for the installation of additonal units at a later date. Over three miles of refrigerant mains are used in this installation which utilises fully 15 tons of ammonia refrigerant to provide all the refrigeration needed for mixing, holding, ageing, freezing and storage in this vast factory.

In addition to its outstanding size and efficiency, this installation is remarkable for the exceptionally high standard of the safety precautions that have been designed into the plant.

York refrigeration air conditioning

YORK SHIPLEY LTD · NORTH CIRCULAR ROAD · LONDON N.W.2

A Member of the Borg-Warner International Group

BIRMINGHAM · DUBLIN · GLASGOW · MANCHESTER · NOTTINGHAM

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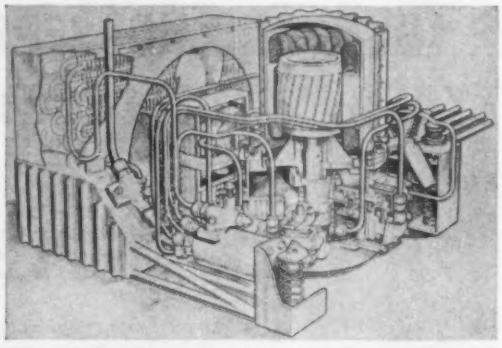
for Domestic or Commercial use

Sylvian (REG'D)

A universal Serviceable *Sealed Unit with* UNIQUE *features*

- ★ LOWER TEMPERATURE MEANS REAL DEEP-FREEZE
- ★ OBVIATES PRE-COOLING AND SECONDARY CIRCUITS
- ★ WIDE VERSATILITY
- ★ DESIGNED FOR LONG LIFE WITH FREON 22



British Patent
UK 680922

Australian Patent
154195

U.S.A. Patent
2738122

New Zealand Patent
105246

While having the advantages of effective "Sealing" this Unit offers every facility for complete testing, maintenance or repair on the spot by ordinary Service Engineers using simple tools. Costly periods of enforced idleness are thus avoided. A special feature of the design is the interlock of main casings, giving exceptional rigidity, and long, trouble-free life.
Readily adaptable to a wide variety of mountings it provides an efficient component, as original or replacement, over a large field of operation.

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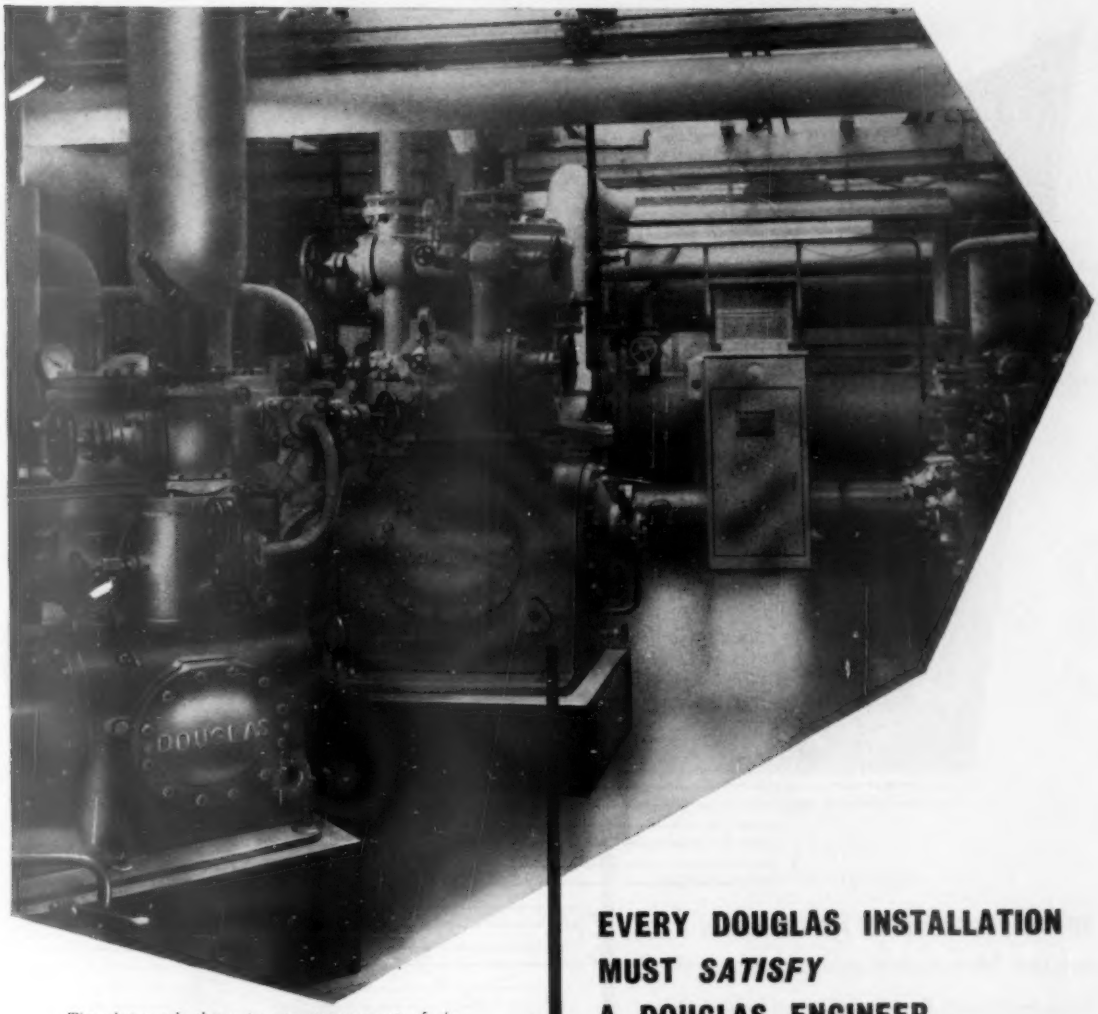
WESTERN DETAIL MANUFACTURERS LIMITED
WESTERN WORKS, STAPLE HILL, BRISTOL, ENGLAND
Telephone : BRISTOL 65-5097 Grams and Cables : ARIES BRISTOL 652825.



The photograph shows two compressors out of six in a two-stage installation serving a number of ice-cream hardening tunnels. The premises are those of Messrs. Nielsons (Ice Cream & Frozen Foods) Ltd., by whose courtesy this photograph is reproduced.

OTHER DOUGLAS EQUIPMENT COMPRISES:

CONDENSERS shell and tube, or evaporative.
INTERCOOLERS
LIQUID AMMONIA PUMPS
EVAPORATORS Plain pipe, finned pipe, shell and tube, submerged type, flooded, etc.
INSULATION and COLD ROOM DOORS for all cold storage and low temperature applications.

DOUGLAS

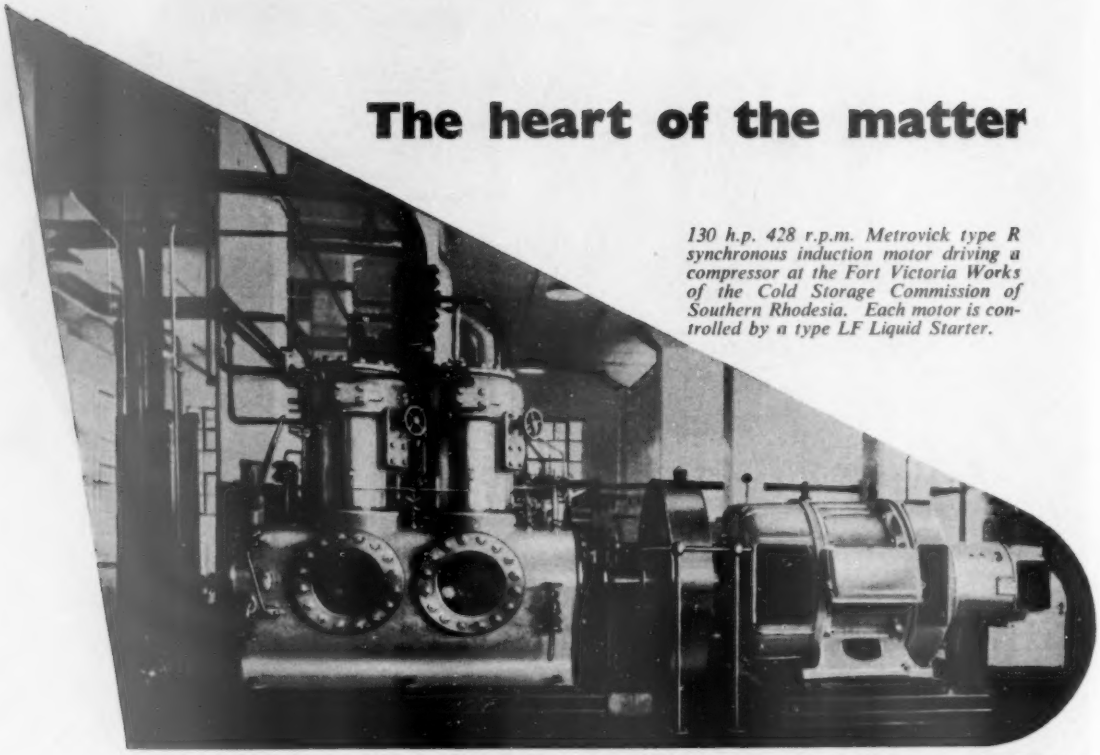
EVERY DOUGLAS INSTALLATION MUST *SATISFY* A DOUGLAS ENGINEER

Reputation, not immensity, has been the foundation of Douglas growth, and every growing reputation depends upon reliability and experience. No less this one. That is why the most thorough care is taken with each installation—to ensure that everything is in perfect order.

Douglas experience, combined with personal service, is appreciated by a considerable number of users. Douglas can probably assist you. Why not think about it?

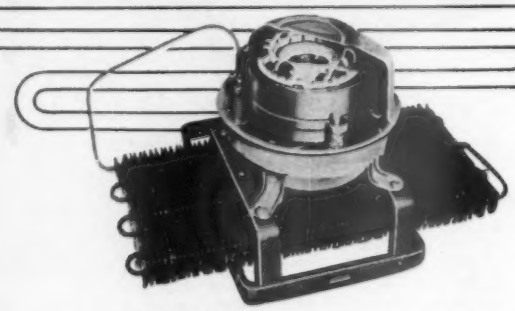
WILLIAM DOUGLAS & SONS LIMITED, DOUGLAS WHARF, LONDON, S.W.15. - - - Telephone: PUTney 8181.

The heart of the matter



130 h.p. 428 r.p.m. Metrovick type R synchronous induction motor driving a compressor at the Fort Victoria Works of the Cold Storage Commission of Southern Rhodesia. Each motor is controlled by a type LF Liquid Starter.

In refrigerating plant it's the motor that matters. Metrovick motors are designed by engineers with first-hand knowledge of the refrigeration industry. They do not stop at B.S. Specifications. Maximum reliability with minimum maintenance is the specification followed. Whatever the size of refrigerating plant, it pays to install one of the range of Metrovick motors.



A Metrovick fractional horse power stator and rotor unit sealed into a Lec Refrigeration Ltd. refrigerator compressor.

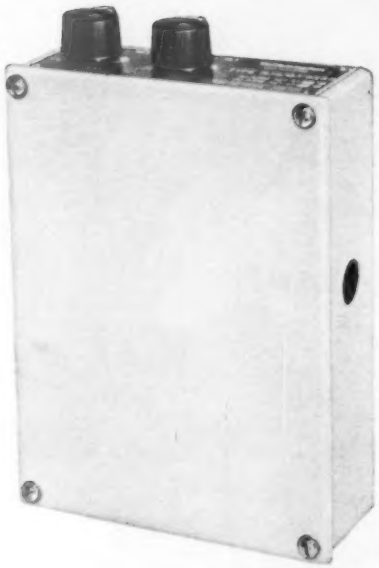
METROPOLITAN-VICKERS
ELECTRICAL CO. LTD · TRAFFORD PARK · MANCHESTER, 17

An A.E.I. Company

Motors for Refrigeration

1/A501

Alarm!



The Teddington Dual Temperature Audible Alarm originally designed for use in hospital blood banks sounds loudly in the event of any undue *rise or fall* in temperature enabling corrections to be quickly made. It can be used for any application requiring an alarm in the event of excessive temperature change.
Alarm sounds in the event of a fault in the thermal system, if mains electricity fails or when desired for testing.

TEDDINGTON REFRIGERATION CONTROLS LTD · SUNBURY-ON-THAMES

Telephone : Sunbury-on-Thames 456 *Telegrams : Trefcon Sunbury-on-Thames*

AUTOMATIC Teddington CONTROLS

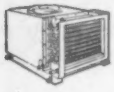
Alarm!

TR66

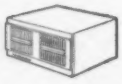
Extremes of heat, dust and humidity need not affect health or efficiency. Temkon air conditioning units make normal living possible in some of the worst climates in the world. Outside, the temperature may soar, but in Temkon-cooled homes and offices there's an air of comfort — clean, dry and temperate.

Self-contained, air-cooled condensing units, 4-25 h.p.

Drinking water coolers



Chilled water or direct expansion air handling unit



Room air conditioner 1-2 h.p.

TEMKON

Air conditioning and refrigeration

Central station installations up to 1000 tons refrig.

TEMPERATURE LIMITED

BURLINGTON ROAD LONDON SW6 ENGLAND • *Phone:* **RENown 5813 (P.B.X.)** *Cables:* **TEMTUR LONDON**
LARGEST PRODUCER OF AIR CONDITIONING UNITS OUTSIDE THE U.S.A.

P.2707

DUNHAM-BUSH

HEATING AND COOLING

Inner-Fin Chillers

Heat-X model CH Inner-Fin Water Chillers (2-35TR) provide a compact highly efficient direct-expansion evaporator for use in chilled water air-conditioning systems and on other liquid cooling applications.

★ **Patented Inner-Fin construction makes the Heat-X Chiller the most compact shell and tube chiller on the market.**

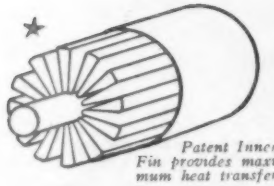
Copper inner-fins in refrigerant passages greatly increase heat transfer efficiency and result in a chiller of MINIMUM SIZE and COST.

Water passages of Heat-X Chillers are of non-ferrous construction throughout, eliminating any corrosion problems. Selection of water baffle spacing is available to meet range of water pressure drop requirements. Since they are single pass, there is no oil-trapping problem.

TYPICAL CHILLERS:

NOMINAL TONS†	MODEL	SHELL LENGTH	SHELL DIAMETER
3	CH 418 — 24A	30″	4⅛″
5	CH 538 — 24A	30″	5⅛″
7.5	CH 538 — 36B	42″	5⅛″
15	CH 612 — 36B	43″	6½″
20	CH 734 – 36A	44″	7⅛″
35	CH 734 — 48A	56″	7⅛″

† Based on Water in 53°F; Water out 45°F; Refrigerant 35°F.



Patent Inner-Fin provides maximum heat transfer.

Comparable size Model 'IC' INNER-FIN SHELL and TUBE CONDENSERS are also available.

Please write for particulars

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Taylors of Mitcham

"OPINION"

"A WONDERFUL PARTNERSHIP"

Apart from the heavy insulation work for which we are world famous, our friends will be interested in our other activities.

In Portable Containers, Air Ducts, Cooler Casings and many other things connected with Refrigeration, timber (good, mind you) and aluminium alloy, plus good craftsmanship, make a wonderful combination!

Strong, pliable, non-corrosive, light, long in service, inexpensive, and pleasing—what more can you want?

Only get someone with experience to design it for you—allow us!

*

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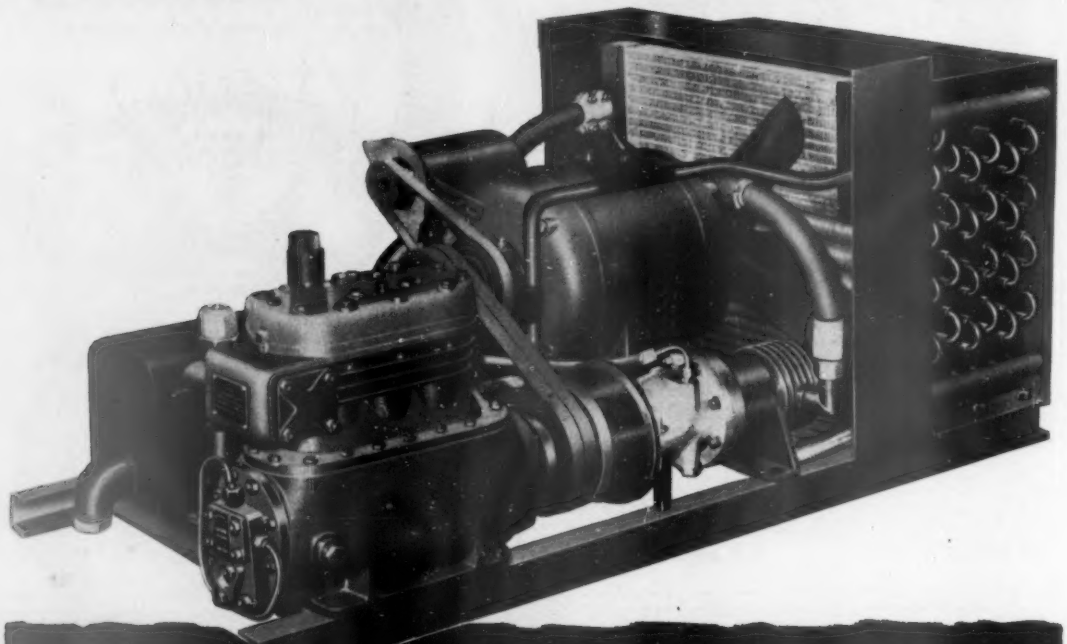
MOBILE TRUCK REFRIGERATION



HERE ARE THE NEW ESSEX HYDRAULIC AND ELECTRO-HYDRAULIC MODELS

Here are the unique advantages of the "Essex" system built into a smaller more powerful unit, with remarkable economy and flexibility of performance never before possible in truck refrigeration. The greater capacity of these units gives a quicker temperature reduction than any other application, and the noise level is practically negligible. All "Essex" models can be plugged into the electric mains for constant refrigeration when the truck is stationary during the day or night. Never before has such highly developed Mobile Truck Refrigeration Equipment been available. Years of experience have produced the internationally known range of "Essex" Truck Mobile Refrigeration Units. Self-contained they slide into container units and are to be had for the asking. We also manufacture built-in type units for installation below body line.

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Heat Transfer
The secret of success in I.C.I.'s three well-known heat-transfer materials is their *integral* construction. This ensures maximum heat-exchange efficiency and eliminates any risk of mechanical failure. Whether you need sheets with tubeways to your own design . . . . . long-length strip with parallel tubeways . . . . or extended surface tubing . . . . I.C.I. Metals Division can help you.
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METALS DIVISION
IMPERIAL CHEMICAL INDUSTRIES LIMITED, LONDON, S.W.1
KL.24A

It takes feeling as well as thinking...

What exactly does 'design' mean? Some electrical engineers restrict it to electrical design. But this is only the half-way house. The full sense must surely include everything that dictates what shall be made—down to the working drawings and detailed production methods. In these later stages less can be calculated, more depends on that cerebral computer, imagination which, often delivers its answers: as a direct feeling for the right job. How right in practice depends on the experience of the designer—and of the company for which he works.

Take, for instance, fractional horsepower motors...

Take our new 'T' range in particular. The electrical design was orthodox, the calculations based on accepted principles. But in constructional design, we, like everyone else, had to rely to a considerable extent on our designers' flair—their feeling for the right job. In the cooling system, for instance, we adopted a low-velocity central discharge, because we felt that the advantages of this arrangement far out-weighed any extra manufacturing difficulty.

On points like this there is almost always argument—in which the common stock of experience of the works plays a decisive part. And, having been in the game so long, the stock is large and the argument hard fought.

Crompton Parkinson LIMITED

Member of ATOMIC POWER CONSTRUCTIONS LTD

One of the five British Nuclear Energy Groups

MAKERS OF ELECTRIC MOTORS OF ALL KINDS · INSTRUMENTS
ALTERNATORS AND GENERATORS · SWITCHGEAR
B.E.T. TRANSFORMERS · CABLES · CEILING FANS
LAMPS · LIGHTING EQUIPMENT · BATTERIES
STUD WELDING EQUIPMENT · TRACTION EQUIPMENT

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'MR' small ads

Prepayment of Classified advts. is requested.

Replies to Box No. advts. to be addressed to Box No.——, MODERN REFRIGERATION, Maclaren House, 131 Great Suffolk Street, London, S.E.1.

SITUATIONS VACANT

6d. per word. Minimum 12/6. Box 2/- extra.

DRAUGHTSMAN. Vacancy for an experienced man with knowledge of Refrigeration. Permanent position. Pension scheme in operation. Canteen. Good working conditions. Expenses paid for interview.—Wm. Douglas & Sons Ltd., Douglas Wharf, Putney, S.W.15. 1094

ENGINEER required by a Light engineering company manufacturing small electro/mechanical instruments in large quantities. Some previous experience of refrigeration engineering would be an advantage. It is essential that applicants have an engineering qualification, and have an over-all engineering experience covering modern production methods and experimental work. Age 35-45. The Company is located in the south-west Middlesex area and the successful applicant will be responsible to the Managing Director. Please write stating full details of previous experience, age and salary required to Box 1239. 1239

ESTIMATING or Estimating and Sales Engineer for industrial refrigerating plant in varied applications. There is some flexibility in the position which can be suited to individual qualifications but some experience in this work is essential. Pension scheme. Five day week. Please write giving age, qualifications and experience to The Sales Director, Wm. Douglas & Sons Ltd., Putney Bridge, S.W.15. 1223

Hawker Siddeley — GUIDED WEAPONS DIVISION

REFRIGERATION ENGINEER

A vacancy exists in the Weapons Research Division of A. V. Roe & Co. Limited at Woodford Aerodrome, Cheshire, for an experienced Refrigeration Engineer to assist in the development and testing of airborne refrigeration and air conditioning systems.

This is an interesting and permanent position for a suitable applicant, and the Division is situated in a pleasant part of Cheshire, within easy reach of the Derbyshire hills and on a main bus route.

Applications giving details of age, experience and present salary should be addressed to:—

The Chief Engineer,
A. V. Roe & Co. Limited, Weapons Research Division, Woodford, Cheshire.
quoting reference No. WRD/WGJ/R.66/M.

EXPANSION, expansion, expansion, as a result we need Refrigeration Salesmen and Service Engineers. Top pay, salary, commission, permanency. Only experienced people.—Frostaire, Refrigeration House, Muswell Hill. Tudor 8331. 1222

PRODUCTION and Sales Manager, to introduce manufacture of Frozen Food Products. Progressive firm having cold rooms and deep freeze storage facilities, also dry storage. Good prospects for energetic man. Write giving details to Box 1185. 1185

REFRIGERATION Service Engineers required by Agents for first-class equipment. Somerset area. Experienced Domestic and Commercial up to 5 h.p. Clean driving licence. Permanency. Applications treated confidentially.—H. S. Phillips & Son Ltd., Langford Road Works, Weston-super-Mare. 1169

REFRIGERATION Service and Installation Engineer required by firm of 37 years establishment, and main distributors for York Shipley for East Anglia. Applicant must be fully experienced on "Freon" equipment up to 5 h.p., preferably up to 15 h.p. Able to drive (with clean licence). Good wages and overtime rates, annual bonus, participation in sales commission. Superannuation, security and house available to suitable applicant. Reply giving full details in confidence to Mr. A. S. Playle, Joint Managing Director, Playle of Maldon Ltd., Refrigeration Engineers, Witham, Essex. 1207

TWO REFRIGERATION Service Engineers required for Brighton and Southampton District by Distributors of nationally known equipment. Must be fully experienced and be able to produce first class references. Apply in writing to Carter & Finmore Ltd., Onslow Road, Southampton. 1191. 1194

REFRIGERATION SERVICE MECHANIC required to operate from Finborough Hall, Stowmarket, Suffolk. The rate of pay (at present 4/10½d. an hour) and conditions of employment in accordance with N.J.I.C. Agreement for Electricity Supply Industry. Applications, giving details of age and experience, to The Secretarial Officer, Suffolk Sub-Area, Eastern Electricity Board, Finborough Hall, Stowmarket, Suffolk. 1236

REFRIGERATION Sales engineers required for varied industrial work in London and Provincial offices. Excellent prospects for energetic men in expanding organisation. Previous experience not essential, but candidates should have H.N.C. or equivalent as minimum qualification. Full details to Box 1234. 1234

RESEARCH and Development Engineer required in an expanding laboratory. Applicants should have a degree or Higher National Certificate in mechanical engineering and be particularly interested in thermo dynamics as applied to domestic refrigerators. A practical background in light engineering is desirable. This is an excellent opportunity for an engineer to have an interesting post with attractive working conditions and salary in a progressive Company. Applications in writing stating qualifications, experience, age, etc., will be treated in confidence and should be addressed to Personnel Manager, Astral Equipment Ltd., Industrial Estate, Dundee. 1233

REFRIGERATION engineer, for service and installation of all types of commercial refrigeration required to operate from Southampton. Only fully experienced men need apply. Give full details to Carter & Finmore Ltd., Onslow Road, Southampton. 1229

WORKS SUPERINTENDENT (AIR-CONDITIONING AND REFRIGERATION) required by NIGERIA FEDERAL GOVERNMENT P.W.D. on contract for tour of 12 to 24 months in first instance. Salary according to age and experience in scale (including Inducement Addition) £1,014 rising to £1,614 a year. Gratuity at rate £150 a year. Outfit allowance £60. Free passages for officer and wife. Assistance towards children's passages and grant up to £150 annually towards maintenance in U.K. Liberal leave on full salary. Candidates should have served an apprenticeship and have had at least three years' subsequent experience of repair, maintenance and installation of air-conditioning and refrigerating plant and components including compressors, evaporative condensers, diesel engines and electric motors. Machine shop experience essential and ability to supervise manufacture of small components. Write to the Crown Agents, 4, Millbank, London, S.W.1. State age, name in block letters, full qualifications and experience and quote M2A/50092/MAM. 1224

BUSINESS FOR SALE

6d. per word. Minimum **12/6.** Box **2/-** extra.

REFRIGERATION and Electrical Business. Well equipped various tools and machinery. Centrally situated London area. Good clientele. Very low rent. Owner retiring from refrigeration business. £2,000, includes stock, vans and balance of lease.—Box 1227. 1227

MISCELLANEOUS

6d. per word. Minimum **12/6.** Box **2/- extra.**

A SALES/Service Agency is sought by small organisation for Refrigeration and/or Allied Equipment. At present operating South London and Surrey, with showroom in South London. Skilled staff together with excellent trade connections now exist, with a long and extensive experience of the refrigeration business.—Box 1235. 1235

NEW 300 c.ft. Low Temperature Sectional Cold Room, 8 in. cork insulation. Can be seen in Yorkshire. To be sold with or without equipment.—Box 1225. 1225

CHEAPSIDE Industrial Services Ltd. with which we are associated have for disposal a Douglas 100 ton refrigeration plant, 18° of frost, including two compressor units and diesel engines. This plant supplied new in 1954 has not been unboxed so is as new. I wonder if you know of any firm who would be interested in purchasing this plant for £2,000 or near offer.—Rees, Smith Ltd., 182, High Street, Guildford, Surrey. 1228

COMPRESSORS. We specialise in very short deliveries at highly competitive prices of new Ammonia and "Freon" Compressors in sizes from 7½ h.p. to 220 h.p. Enquiries to G. Williams Engineering Co. Ltd., Disraeli Road, Willesden, N.W.10. ELGar 4225. 1226

SERVICE & REPAIRS

6d. per word. Minimum **12/6.** Box **2/- extra.**

REPAIRS, overhauls and general maintenance effected for the trade. Specialists in absorption and Sealed Unit Mechanisms. Old cabinets modernised including restoving, rechroming, revitreousing, etc., as necessary. —The A.C.R.E. Company, 389, Green Lanes, London, N.4. MOU 0171/2. 836

ARTICLES WANTED

6d. per word. Minimum **12/6.** Box **2/- extra.**

CORK SLAB or other Insulation, large quantity wanted, must be in slab form. Offers to Burleigh, Alpine Works, Empire Way, Wembley, Middx. 1218

SECOND-HAND Deep Freeze Cold Room required. Write giving fullest details, including price.—M.K.G. Food Products Ltd., 111-113, High Street, Harborne, Birmingham, 17. 1230

WANTED, quantity of good, used "Freon" or Ammonia Compressors. State condition, age and price.—Box 1152. 1152

WANTED, all types Refrigeration Spares, Tools, Equipment, Text Books.—Box 1237. 1237

ARTICLES FOR SALE (Secondhand)

6d. per word. Minimum **12/6.** Box **2/-** extra.

FRIGIDAIRE for Sale. Condensing unit model AD3 with direct expansion evaporator coil, suitable for room about 400 c.ft. Apply in writing to the Chief Engineer, The British Drug Houses Ltd., Graham Street, City Road, N.1. 1238

REFRIGERATING equipment suitable for 100 ton Cold Room—11,000 c.ft. capacity. Cold blast type comprising: coils, fans, two 26 h.p. Condensing Units powered by two Lister Diesel Engines. Two sets double doors and four single doors, £1,500 ex. works. Refrigerating equipment suitable for 200 ton Cold Room, 22,000 c.ft. capacity. Cold blast type comprising: coils, fans two 38 h.p. Condensing Units powered by two Lister Diesel Engines. Two sets double doors and six single doors, £2,200 ex. works. Refrigerating Units comprising the following: 5 h.p. S.A.V.T. 4 Lightfoot compressor—Air cooled Condenser—12 volt Dynamo and 12 volt fan mounted together with 5 h.p. Winconsin petrol engine and completely contained in metal cabinet with instrument panel fitted with delivery and suction gauges and dynamo control, £90 ex. works. These Units could be converted to suit mains electricity. —Polarcold Ltd., Congleton, Cheshire. Tel: 2401/2. 1199

REFRIGERATION COMPRESSORS. Several two-stage by Hall and Sterne's, complete motors. Several 6 in. x 6 in., by Hall, Sterne's, Lightfoot; 5 in. x 5 in. Hall, York, G. & J. Weir; 4 in. x 4 in., York, Hall, Sterne's, Weir, Lightfoot, "Freon" VT7 10 h.p. and 7½ h.p., also 3, 4, 5 and 7½ h.p. "Freon" Compressors by Sterne's, York, Hall, etc. Large stockists. Keenest prices in the trade. Export orders receive special attention. Send in your enquiries.—Alfred's Ices (1954) Ltd., 1-5, Hall Place, Church Street, London, W.2. Telephone: PADdington 6619/6610. Telegrams: ICEFRIGO LONDON, W.2. 830

STERNE CONDENSER 16 ft. x 2 ft dia. with Liquid Receiver 13 ft. x 1 ft. 6 in. mounted under (as new), also EVAPORATOR 12 ft. x 2 ft. 3 in. dia. AMMONIA TURBO-COMPRESSOR, II STAGE, very large, weighs 42 tons (particulars on request), unused. THREE "LINDE" AMMONIA COMPRESSORS (two single stage and one II stage) duty 2,000,000 kcal/h at 162 r.p.m. each outfit (UNUSED) with spares and built-in Electric motors. Two "YORK" Y15 AMMONIA COMPRESSORS 10 x 10 twin with motors —many other also available. One Large Hall COMPOUND METHYL or "FREON" COMPRESSOR (unused). All above seen by appointment at Burleigh, Alpine Works, Empire Way, Wembley, Middx. 1217

Owing to unprecedented demand for their revolutionary draught and bottled beer coolers

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STERNE 1MA Twin Cylinder Ammonia Compressor, complete with motor, fully automatic, with shell and tube condenser. New condition, reasonable price. —Box 1240. 1240

WEIR, 2AM water cooled condensing unit, 1½ h.p., 3 ph. motor, Igranic starter, £35.—Parade Restaurant, 40, Furtherwick Road, Canvey Island, Essex. Tel: Canvey 504. 1231

AGENCIES REPRESENTATIVES, ETC.

6d. per word. Minimum **12/6.** Box **2/-** extra.

APPLICATIONS are invited for the position of Technical Sales Representative with a Frigidaire Distributor. Candidates should have Sales Engineering experience, and be able to negotiate and close sales for Industrial and Commercial applications. This is an excellent opportunity providing a high remuneration for a suitably qualified man. Applications in confidence to Box 1219. 1219

REFRIGERATION. Sales representative required by Kelvinator main distributors for Sussex and Surrey. Only fully experienced men with undoubted selling records will be considered. First class salary, commission rate, car provided. Full particulars to Carter & Finmore Ltd., Onslow Road, Southampton. 1232

MODERN REFRIGERATION

and Air Control News

Incorporating
COLD STORAGE AND PRODUCE REVIEW
and ICE AND COLD STORAGE

Established 1898

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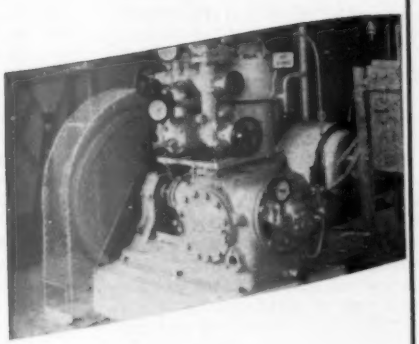

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VOLUME 62 NUMBER 734

May, 1959

Editorial . . . .

Facts about the I.I.R.

Servicemen's Status

New Air-Conditioning Plant

● Following our publication in recent months of news concerning the forthcoming Xth International Congress of Refrigeration in Copenhagen (August 19 to 26) we have received enquiries that reveal that the work of The International Institute of Refrigeration is not as well known as it should be. This is certainly an opportune moment for stating a few pertinent facts.

● The close of the year 1958 marked the end of half a century of international refrigeration activity. In October 1908, the First International Congress of Refrigeration was held in Paris and, in January 1909, the International Association of Refrigeration was established. The great Dutch physicist Kamerlingh Onnes (Nobel prize winner in 1913), proposed the setting up of this association and admirably defined its framework : " réunir toutes les intelligences qui s'interessent aux basses températures."

● Just after the First World War, the International Association of Refrigeration became an intergovernmental organization with the name of the International Institute of Refrigeration (I.I.R.). This new organization carried on the work of the old body without interruption.

● The general objective of the I.I.R. is the *development of the science and technique of refrigeration* in the international field, promoting scientific research, as well as the teaching and the popularization of refrigeration and the development of all applications of refrigeration which improve the living conditions of mankind, particularly in the fields of food, industry, and health. The I.I.R. now numbers 35 member countries. The general conference, under the present chairmanship of Dr. Ezer Griffiths, F.R.S., (United Kingdom), defines every 4 years the main tasks of the Institute. The executive power belongs to the executive committee (President : M. Foulon, Belgium). The technical board (President : Dr. Fidler, United Kingdom) co-ordinates the scientific and technical activity of the nine international commissions (very low temperature physics, exchange of heat and thermal insulation, construction of refrigerating machinery, applications of refrigeration to agriculture, industry and biology ; refrigerated transport by land, by sea and by air ; education). The headquarters of the Institute is at 177, boulevard Malesherbes, Paris (17°). The Institute is most ably directed by Monsieur R. Thevenot.

● With the widening of the applications of refrigeration, the committee of the Refrigeration Servicemen's Association have felt for some time that the association should take further steps to assist members in their particular field. Specializing in part of an industry has been recognised for some time by other bodies who, after a candidate has passed a certain standard in that trade or profession, allow him to sit for an examination in a specialist subject that he intends to make his career. With this in mind, a resolution has been passed that a three-year study course be devised for members. The first two years' study will be devoted to the study of refrigeration but the third year devoted to the study of the particular subject—installation, air-conditioning, etc., in which the member wishes to specialize. This means that all members will be catered for, irrespective of the branch of the industry in which they are working. Two examinations will be held each year at six monthly intervals for each part of the course.

● It will be appreciated that a lot of work has to be done on such a project as outlined above and it is hoped that the first part will be ready by the opening of the winter session. It is pointed out that this course is not intended to replace the City and Guilds no. 72 refrigeration practice course but will be offered as an alternative. Members who pass either the City and Guilds no. 72 or the R.S.A. course will be recognised by the use of the letters MEM.R.S.A., after their name. This has led to an alteration in by-law 9 as follows :— 9(a) Each member shall be entitled to use after his name the letters " A.MEM.R.S.A." 9(b) Each junior member shall be entitled to use after his name the letters " J.MEM.R.S.A." 9(c) Each member after passing either the City and Guilds no. 72 refrigeration practice examination or the R.S.A. examination shall be entitled to use after his name the letters " MEM.R.S.A."

● Research and product development, which were responsible for many innovations seen at the recent air-conditioning show in Philadelphia, have a solid background in the fundamental studies conducted by the American Society of Heating and Air-Conditioning Engineers, under whose auspices the exposition was held. The society now has a dozen research projects under way in its own laboratory and in co-operating institutions, ranging from the cleaning, distribution, infiltration and sterilization of air to the generation and attenuation of noise, certain physiological studies, and the utilisation of solar heat.

● Equipment for heating and cooling in the industrial, commercial, and institutional fields was heavily represented at the exposition, with the emphasis on improvements all down the line. For central high velocity air systems, two new methods of controlling volume and temperature were shown, while a new central system of combined heating, air-conditioning and ventilation for blocks of flats, hotels and offices, provides a separate blower for each space but reverses air circulation according to heating or cooling phase. For heating, hot air is discharged across the ceiling and exhausted at low level on the same side of the room. For cooling, the operation is reversed and cold air is forced across the floor and exhausted at the ceiling line. The show indicated considerable variety in water chillers. These ranged from smaller cooling

units to heavy industrial equipment. Two manufacturers in America are now using heat to produce cold, employing lithium bromide as the absorbent, while a new exhibitor of gas-operated, year-round air-conditioning is also employing it as an absorbent.

● One of the more active areas for development is air filtration and a number of new ideas were unveiled at Philadelphia. A plate type electronic air cleaner, patterned after units developed for United States submarines, was offered for installation in the cold air return of any forced air heating or cooling system. Activated by a power pack which plugs into any electrical outlet, a disposable collecting pad may then be replaced when a " filter gauge " indicates that such a step is necessary. An electrostatic air filter was shown having a newly-developed medium consisting of layers of woven plastic fibre held under spring tension —the inherent characteristics being maintained and increased by the through-flow of air. Another innovation was a filter made of specially developed synthetic fibres bonded in an interlocking pattern calculated to minimize surface loading and assure full depth filtration. Treated with a germicide, it not only kills bacteria, but also inhibits mould and mildew. At least two exhibitors offered portable air filters for home and office use. One, having two chemically treated filter mats, has twin blowers. The other draws air over an ultra-violet lamp, then through an electrostatic filter which removes dust, pollen, leaf mould and even smoke particles.

● The Milan Trade Fair (April 11 to 27) was a revelation to the writer. Within the compass of 480,000 square yards was displayed the most comprehensive range of products, from heavy engineering to household, yet assembled in one showground. Those British firms who boldly defied the doleful prospects, for the U.K., of " common market " activity and were represented appeared to have been well rewarded.

*

● It is all the more disappointing, therefore, to learn that the number of British exhibitors for the 11th Liège International Fair, which was opened on April 25 by Belgium's Prime Minister, Monsieur Van Houtte, was very much smaller this year. From nearly 50 firms in 1958, all of which were attracted by the promise of the impending establishment of a European free trade area, only 27 were left, because these hopes failed to materialize.

A.E.I.'s VAST TRADE

At the 59th annual general meeting of Associated Electrical Industries Ltd., held at 33, Grosvenor Place, London, S.W.1, The Viscount Chandos, P. C., D.S.O., M.C., (the chairman), presided. The chairman said, in part :—

" We have (also) elected to the board, at the end of the year, Mr. R. Craig Wood, the managing director of the Hotpoint Company, who has made a notable success of our business in household appliances.

" During the past year we have paid three quarterly dividends of 2½ per cent. Your directors recommend the payment of a final dividend of 7½ per cent., making a total distribution of 15 per cent., the same rate as for 1957. The ordinary share capital, which was £33,639,000 at the 31st December, 1957, had been increased to £38,179,000 by the end of 1958 and has since then been increased to £38,304,000. The first interim dividend was paid on the old capital, the second on £34,795,000, and the third interim dividend was paid on the capital as finally increased. The first increase of capital was made for the acquisition of the assets of Associated Insulation Products ; the capital was further increased on the acquisition of W. T. Henley's Telegraph Works Co. Ltd., which was effected by an exchange of shares. The 4½ per cent. ' B ' preference capital of the company had been increased from £4,426,700 to £4,614,000 by 31st December, 1958 and subsequently to £4,627,000. This is due to the exchange of our preference shares for those of Henley's. At the end of the year we held 96·4 per cent. of the ordinary capital in that company, and we now own all the preference and ordinary capital. Our trading profit for the year, before taxation, but after deduction of other charges, amounted to £11,069,000, compared with £9,988,000."

Royal Mail Lines announce that the launch of R.M.S. *Amazon*, first of their three air-conditioned and stabilized 20,000-ton passenger liners, will take place at Belfast on July 7, 1959, and Her Royal Highness Princess Margaret has graciously consented to perform the naming ceremony. It is expected that *Amazon* will leave for her maiden voyage to South America on January 22, 1960, followed by her sister ships *Aragon* on April 29 and *Arlanza* on October 7, 1960.

* * *

Sir Ernest H. Murrant, K.C.M.G., M.B.E., has resigned from the directorates of Royal Mail Lines, Ltd. (of which he is also deputy chairman), The Pacific Steam Navigation Company and Royal Mail Agencies (Brazil), Ltd. with effect from March 31, 1959. Mr. Frank Charlton has resigned from the same date as deputy chairman of The Pacific Steam Navigation Company but will retain his seat on the court of directors of that company and on the board of Royal Mail Lines Ltd. Mr. H. Leslie Bowes, C.B.E., has been elected from April 1, 1959, deputy chairman of Royal Mail Lines Ltd., and The Pacific Steam Navigation Company, whilst retaining his present office of managing director of both companies. Mr. W. Errington Keville, C.B.E., has been appointed a director of Royal Mail Lines Ltd., The Pacific Steam Navigation Company and Royal Mail Agencies (Brazil) Ltd.

* * *

At the annual general meeting of the British Industrial Measuring and Control Apparatus Manufacturers' Association held on March 3, 1959, Mr. W. G. Thomas (Bailey Meters & Controls Ltd.) was elected as president of the Association and Mr. V. D. MacLachlan (Honeywell Controls Ltd.) was elected chairman.

NEWS OF THE MONTH

Refrigeration and A-c. Exports.—During March 1959, air-conditioning and refrigerating machinery (commercial and industrial sizes) to the value of £755,923 weighing 1,225 tons, was exported from Great Britain. Comparable figures for March 1958 were 1,283 tons, worth £848,929.

* * *

Exports' Analysis.—Of the 1,225 tons of air-conditioning and refrigerating plant worth £755,923 exported by Great Britain in March—quoted in the preceding paragraph—54 tons went to the Union of South Africa, 56 tons to India, 63 tons to Australia, 13 tons to New Zealand, 18 tons to Canada, 173 tons to " other Commonwealth countries," 30 tons to Eire, 12 tons to Sweden, 165 tons to Western Germany, 39 tons to the Netherlands, 174 tons to Belgium, 37 tons to France, 48 tons to Italy, and 343 tons to " other foreign countries."

* * *

Refrigeration Plant Classified.—Of the total exports of air-conditioning and refrigerating machinery during March, quoted in the first paragraph, commercial refrigerators accounted for 356 tons, worth £192,623, industrial plant and equipment for 154 tons worth £63,708, and refrigerating Equipment and parts, including parts of commercial refrigerators, for 389 tons, worth £292,282.

* * *

Exports of Small Refrigerators.—During March, 1,270 tons of complete refrigerators and domestic refrigeration equipment were sent overseas from Great Britain. These exports were worth £829,093. The 1,270 tons comprised 34 tons to the Union of South Africa, 27 tons to Rhodesia and Nyasaland, 3 tons to India, 10 tons to New Zealand, 688 tons to " other Commonwealth countries and Irish Republic," 4 tons to Sweden, 36 tons to Western Germany, 3 tons to the Netherlands, 18 tons to Belgium, 88 tons to Italy, and 359 tons to " other foreign countries."

* * *

New Cold Store for Birds Eye.—To supplement their two small cold stores at the Kirkby Trading Estate, Liverpool, Birds Eye Foods Ltd. have planned the construction of a new cold store for quick-frozen foods. Smiths Insulations Ltd., of Burton-on-Trent, have been awarded the contract for the cold store structure. The internal dimensions of the proposed store are : length 294 ft., width 105 ft. and height 19 ft. Smith's normal prefabrication technique will be used to provide quick assembly on site with saving of time and labour. The store will be fully equipped for quick and easy handling of the products using a railway dock, covered siding and covered loading bay and an internal painted floor pallet layout. Insulation will be 10 in. for walls and ceiling and 8 in. for the floor ; the interior finish in polar white and the floor granolithic. Site operations are already well under way.

* * *

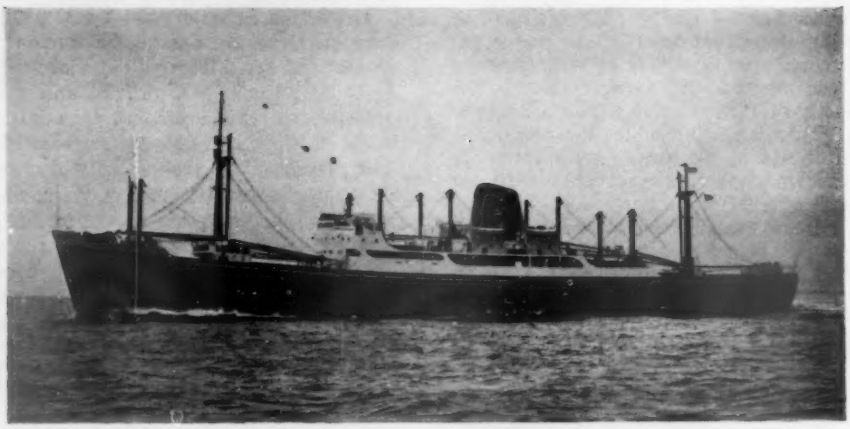
Helium liquefier, designed by the Cryogenic Engineering Laboratory of the U.S. National Bureau of Standards Boulder (Colorado) Laboratories, is one-tenth the size of that proposed for the U.S. Navy Bureau of Aeronautics. D. B. Mann (left) liquid helium project leader, designed the liquefaction process equipment. B. W. Birmingham (right), assistant chief of the Cryogenic Engineering Laboratory, carried out studies of the feasibility of helium liquefaction and transportation at or near its liquid density.

Gas Appliances Sales.—Recent figures issued by the Gas Council show that sales of the major gas appliances increased sharply following the relaxation of hire purchase restrictions. Cooker sales in the December quarter of 1958 were at an annual rate of over 840,000, 42 per cent. higher than in the corresponding quarter and in the nine months there has been an increase in cooker sales of almost 16 per cent. The high rate of sales has since been well maintained. Increased sales of other appliances were also stimulated by the relaxation of hire purchase restrictions, sales of space heaters being 74 per cent. higher, water heaters 61 per cent., wash boilers and washing machines 21 per cent. Refrigerator sales were more than five times as high as sales in the corresponding quarter of 1957.

Irradiation Laboratory.—A new irradiation laboratory has been opened at the Barton Works, Manchester, of the Metropolitan-Vickers Electrical Co. Ltd. Its purpose is to provide an irradiation service available to other firms and organisations interested in the possibilities of electron irradiation as an industrial process. The laboratory will undertake experiments in the disinfestation of grain, the preservation of foodstuffs, the sterilisation of medical and pharmaceutical materials, the curing of rubber, the polymerisation of plastics and many other irradiation processes which would otherwise involve interested parties in the provision of costly equipment and trained personnel. The main item of the new laboratory's equipment is a 4 MeV linear accelerator.

PICTURE OF THE MONTH

The engineering pavilion at the 37th Milan Trade Fair is typical of the fine permanent structures that are the order of the day at this great event. On the opening day of the fair the flags of thirty-five nations were hoisted on the tall masts above the Palace of the Nations to flutter in the blue and peaceful April sky. These were the banners of Argentina, Austria, Belgium, Bolivia, Canada, Czechoslovakia, Denmark, Dominican Republic, Ethiopia, Finland, France, Germany (Western), Great Britain, Greece, Holland, Hungary, India, Libya, Luxembourg, Morocco, Mexico, Monaco, Norway, Pakistan, Poland, Portugal, Romania, San Marino, Somaliland, Spain, Sweden, Switzerland, Turkey, United Arab Republics, and Yugoslavia. Much refrigeration plant was exhibited as can be seen on pages 470 and 471 of this issue.



SHAW SAVILL'S "IONIC"

The *Ionic*, the 20th vessel built for the Line since World War II, is the third Shaw Savill ship to bear that name. Many will remember the second *Ionic*, a famous passenger and cargo carrier—which performed sterling service as a transport in the 1914-18 War, and was sold for breaking up in 1937—after 35 years of almost unbroken service in the United Kingdom-New Zealand trade. She has a service speed of 17 knots and in her six cargo holds, four of which are insulated, she has capacities for over 400,000 c.ft. for refrigerated and chilled cargo and about 240,000 c.ft. for general cargo. Her propelling machinery consists of a single acting two-stroke cycle opposed piston type Harland & Wolff diesel engine of their latest design. This engine is arranged to operate on boiler fuel. The eight cylinders are capable of developing 13,300 shaft horse-power when operating at 117 r.p.m.

Pioneer Use of Polyurethane Foam in Insulated Holds

THE new Shaw Savill refrigerated liner *Ionic* recently left on her maiden voyage to Australasia.

Some points in the construction of her insulated spaces deserve special mention. The cargo chambers for the carriage of refrigerated foods are insulated with Cape Asbestos white wool on overheads and sides all round, retained in position with Oregon pine plywood erected on the "Mersey System," *i.e.* horizontal and vertical joints formed of galvanized rolled mild steel sections with sealing compound inserted to ensure airtightness. Linings are held in position with Mersey patent attachments at 2 ft. centres and heavy density compressed slab cork grounds are fitted on face of beams, frames and stiffeners secured with hot bitumen.

Tank tops generally are insulated with white wool sheathed with two layers of P.T. & G. boards secured to wood grounds buried in the insulation. English elm, 2 in. thick, is fitted in way of hatch square in lieu of the top layer of P.T. & G. boards.

An interesting feature on the above vessel is the introduction of polyurethane foam, as the insulation medium, which has been fitted throughout No. 5 hold, *i.e.* overhead, shipsides and boundary bulkheads and tank top. In addition, three sets of main hatch insulated plugs constructed of Fibreglass reinforced polyester, foam filled, have been fitted and the remainder of main hatch plugs constructed in timber have rigid foam filling, likewise all cargo doors, limber and manhole plugs.

The vessel is of the following dimensions :—

Length over-all	about 512 ft.
Breadth moulded	70 ft.
Depth moulded to shelter deck	41 ft. 6 in.
Load draught	about 30 ft. 9 in.
Deadweight	,, 11,900 tons
Gross tonnage	,, 11,000 tons
Refrigerated cargo capacity ...	,, 411,000 c.ft.
General cargo capacity ...	,, 239,000 c.ft.
Speed on service	,, 17 knots.

The construction has been carried out under Lloyd's special survey for the Classification 100 A.I., and the vessel complies with the latest requirements of the

Ministry of Transport and has Lloyd's R.M.C. certificate.

Two complete decks, the shelter deck and upper deck, are fitted, and in addition a main deck is fitted forward and aft of the machinery spaces.

A lower deck is fitted in cargo spaces nos. 2, 3, 4 and 5.

Oil fuel bunkers are formed each side of the main machinery space and the double-bottom tanks are all allocated for carrying diesel oil, oil fuel or water ballast, with the exception of one tank for fresh water. Water ballast is also carried in the fore and aft peak tanks.

Cargo is carried in six compartments comprising holds and 'tween deck spaces. Nos. 1 and 6 spaces, together with the centre portion of no. 2 upper 'tween deck and the bridge 'tween decks are allocated for the carriage of general cargo. Lockers for carrying chilled cargo are built in the sides of nos. 2 and 3 main and upper 'tween decks and no. 4 upper 'tween deck together with a pair of low temperature lockers in no. 3 main 'tween deck. All other spaces are for frozen cargo.

Large cargo hatches are fitted, those exposed to the weather having the latest type of MacGregor patent steel sliding covers. They are served by 3-, 5- and 7-ton derricks supplemented for heavy loads by a 50-ton derrick on the foremast over no. 2 hatch and a 25-ton derrick on the mainmast over no. 5 hatch. All derricks are served by electrical winches of Laurence Scott & Electromotors Ltd. make, with Jennings topping winches for 3-ton derricks. An unusual feature is that, although they carry heavy derricks, both masts are designed to stand without stays.

Other auxiliary machinery includes a windlass and two capstans by Messrs. Clarke Chapman & Co. Ltd. and electric hydraulic steering gear by Messrs. J. Hastie & Co. Ltd.

Four 24-ft. glass reinforced plastic lifeboats by Watercraft Ltd., one with motor and three with Fleming gear, are fitted on gravity davits of Welin-MacLachlan manufacture.

REFRIGERATION AIDS TREATMENT OF CANCER PATIENTS

THE successful preservation of living bone marrow cells, that will make a " bone marrow bank " possible, has been achieved by Dr. Nathaniel B. Kurnick, chief of the hematology service of the American Veterans Administration hospital at Long Beach, California.

Live bone marrow cells have been preserved in a frozen state and later injected into the patients from which they were drawn. The intravenous injections produced dramatic improvement in the low blood counts of patients who were receiving radiation therapy for cancer, Dr. Kurnick reports.

Bone marrow was taken from four cancer patients at the hospital. The marrow was slowly frozen in glycerol to keep ice crystals at a minimum and was maintained at minus 79° C. Cells may be stored in this manner for at least one year, and perhaps indefinitely, Dr. Kurnick believes.

When the patient's blood showed a dangerously low level of vital elements because of injury to the marrow from X-rays, the preserved marrow was thawed and injected.

Vigorous growth of new bone-marrow cells was noted after the injections. Blood counts returned to nearly normal within a month to six weeks. There were no adverse side reactions to the injections.

Now that preservation of bone marrow has proved to be successful, cancer patients can be treated much more intensively with radiation than has been thought advisable in the past, the doctor says.

Because the body rids itself of all foreign tissue and cells, it will not be possible to transplant healthy bone-marrow cells from one person to another except in identical twins.

Air-conditioned Office.—When the office of Mr. A. H. Jones, the managing director of Grosvenor House, was recently redesigned by R. D. Russell & Partners one of the stipulations was that it should be provided with air-conditioning. The designers wanted a plant which would act as an independent unit and they therefore chose a Tempair model (150/FS) with a 1½-h.p. motor. To save space in the office the unit is contained in a brick-built house (5 ft. deep, 4 ft. 6 in. wide and 6 ft. 9 in. high) on an adjoining flat roof. Ductwork was provided by Ashwell & Nesbit (who also installed the plant) with a conditioned air inlet at high level and a low-level outlet for exhausted air. Air-control is obtained by a panel situated in a filing cabinet and this allows thermostatically controlled air to be supplied to the office at between 65° and 72° F.; alternatively a ventilation fan can be used. The plant dehumidifies, heats or cools air and makes eight changes per hour.

Grosvenor House's new restaurant has a main ceiling in three tones of gold, red silk-damask curtains to the windows overlooking Hyde Park, oyster wall-panels, and a bluish-purple carpet. The front and sides of the refrigerated buffet are in Honduras mahogany. (Interior designers: R. D. Russell & Partners.)

New Air-Conditioned and Refrigerated Buffet

RECENT INSTALLATION AT GROSVENOR HOUSE

IN Grosvenor House's redesigned restaurant, a new air-conditioning system and an 11-ft.-long refrigerated buffet have been installed.

The new plant makes eight air changes an hour and humidifies, dehumidifies, filters, cleans, heats and cools air. The constant internal temperature of the restaurant is fixed at 68° to 70° F. with 50 per cent. relative humidity. To nullify mechanical and structural noise the new plant room on the flat roof above the restaurant is insulated with mineral wool (faced with expanded aluminium) and machinery is mounted on spring insulators on a raised steel framework. The framework extends beyond the plant room and rests on insulated pads of Mascolite on existing beams.

Air is introduced into the restaurant through Deflecto grilles set in the upstand between the main and the dropped ceiling and through the anemostats above the chandeliers. Exhausted air is extracted through grilles set in the window sheif, under the *banquette* seating, in the ceiling of the stage, and over the service exits. It then enters existing builders'-work ducts.

The buffet has an 8-ft.-long glazed refrigerated cabinet, two rosewood flaps for the display of fruit, and refrigerated storage space for additional dishes. Smoked salmon is carved on a salmon-shaped board made by David Pye. A stainless steel self-supporting tray draws out for the removal of dishes and two adjacent tables are used by the carver. The front and sides of the buffet are in Honduras mahogany.

So that the buffet can be moved it is made in two halves joined by satin-brass fitments ; each part is on 4-in. Autoset castors. Each unit is sub-divided to contain the refrigeration unit and a refrigerated storage compartment. The doors to the units are of louvred stove-enamelled mild steel but the storage compartments have insulated mahogany doors.

The glazing to the display cabinet is ¼-in. plate glass on a framing of stainless steel, and sliding front panels allow the cabinet to be cleaned easily.

Interior designers : R. D. Russell & Partners.

Mechanical consulting engineers : Winton Thorpe, Tunnadine & Partners.

Air-conditioning :

Installation of some machinery : Ashwell & Nesbit.
Electronic controls : Honeywell Controls.
Refrigeration machinery : Harcold Refrigeration.

Refrigerated buffet :

Cabinet : George Barker & Co. (Leeds).
Installation : R. E. A. Bott (Wigmore Street).

SOME ASPECTS OF THE RAIL TRANSPORT OF WET FISH

By D. L. NICOL

Humber Laboratory, Department of Scientific and Industrial Research, Hull.

ROUGHLY half the fish landed in the U.K. is transported by rail from the port of landing to the inland merchant. Despite the rapid growth of quick-freezing in recent years, by far the larger part of this fish is handled in the form of wet fish or fillets packed with ice. In order to minimize the deterioration of this fish during distribution it is desirable that it should be kept at temperatures as near as possible to 32° F. This paper describes work carried out by D.S.I.R. in recent years to elucidate some of the problems of achieving and maintaining this condition during the rail journey.

The question of handling fish from the time it is caught to the time that it is eaten must be viewed as a whole and no one link in the chain of distribution can usefully be assessed in isolation from the others. It is therefore necessary to give some attention to the temperature history of fish before it is loaded into the railway wagon.

The greater part of the fish eaten in this country is caught by middle and distant water trawlers. The fish is gutted at sea and stowed in ice. At the time of loading it will have been kept in this way for a period which may vary from two days to more than two weeks. Thus, it is not surprising that at the time of landing most of the fish is within a degree or so of 32° F.[1]

However, when the fish is displayed on the market it is separated from the ice and begins to warm up. Fish is unloaded between midnight and 8 a.m. and although some will be filleted, packed and dispatched before midday, some of it will remain without ice until the afternoon. During this time its temperature may rise to the region of 40° to 45° F.[1]. Also a large proportion of the fish is filleted during which process it is immersed in water at mains temperature. For this reason the majority of fillets are at a temperature close to 50° F.

Thus, when fillets are packed with ice, the ice has not merely to deal with heat entering the box but also to cool the load from, say, 50° to 32° F. Wet fish is a poor conductor of heat (k = 0·33 B.t.u./hr./ft.²/°F. per ft.) and any large mass of it will only cool slowly. Considerable attention has been given to the problems of transient conduction in a mass of fillets and it has been shown[2] that the standard methods for the calculation of temperature distribution under these conditions give results in good agreement with the observed values.

One common example of commercial practice is the two stone box, in which there is a layer of fillets about 4 in. deep with a layer of ice on top. The rate of cooling of such fillets, assuming a uniform initial temperature of 50° F., is shown in fig. 1. In considering the time scale it should be remembered that fish trains run at passenger train speeds and that most of the fish has a journey of less than 12 hours, and it is most unlikely to be in the van for more than 18 hours.

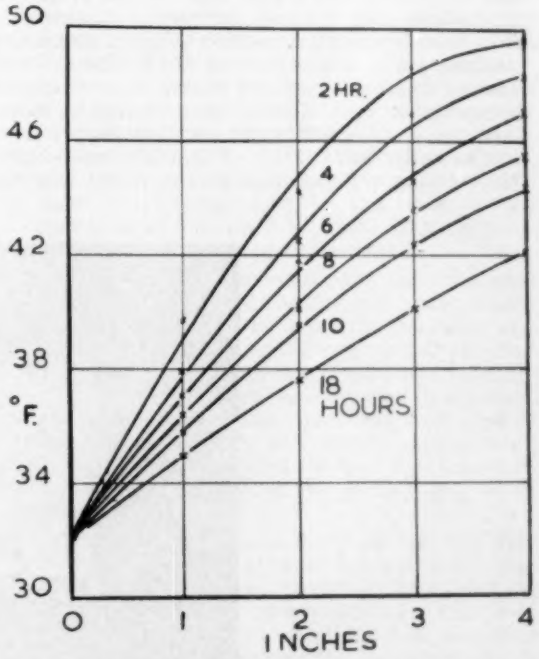


Fig. 1.—Temperature distribution in a 4-in. layer of fillets, initially at 50°F., iced on the top only.

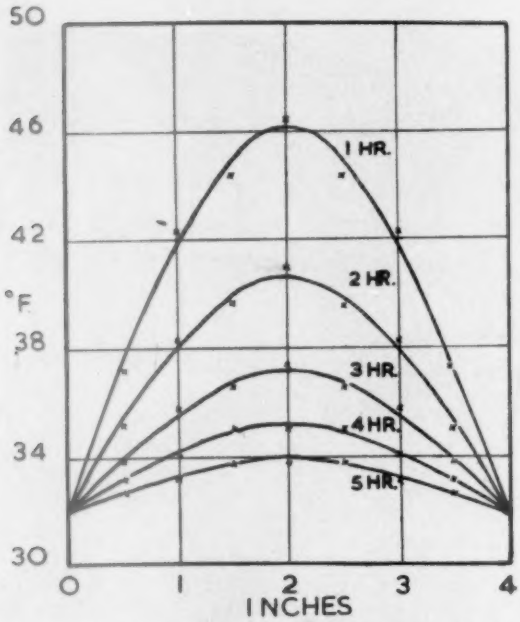


Fig. 2.—Temperature distribution in a 4-in. layer of fillets as in fig. 1 but iced top and bottom.

Sometimes ice is placed at both top and bottom of the box. This slows down the rate of packing, but naturally it gives a great improvement in the rate of cooling. Fig. 2 shows the rate of cooling of a 4 in. layer under these conditions, again assuming a uniform initial temperature of 50° F. In this case cooling could be completed during the average rail journey and provided there was sufficient ice in the box the fillets would reach their destination at a temperature near to 32° F. It should be emphasized, however, that this method of packing is only practised by a few firms and sometimes only in the summer months.

A considerable number of calculations covering the normal variation in sizes of box, methods of packing, and initial temperature of fillets indicate that the temperature of the fillets at the end of the journey is determined almost entirely by the arrangement of fish and ice in the box. Similar considerations apply to whole fish although here the temperature cannot be calculated so readily. The design of the rail van will only affect the temperature of the fish indirectly in so far as it may influence the amount of ice which melts during the journey.

The fish vans used by British Railways vary somewhat in size and in details of construction but a typical modern fish van (fig. 3) could be described as follows :

Internal Dimensions

Length : 20 ft. 6 in.
Height : 7 ft. 9 in. (centre) 7 ft. (eaves)
Width : 8 ft.

Sliding doors on either side of the van are 4 ft. 10 in. wide.

The inside of the van is lined with light alloy mounted on plywood. In between this lining and the outer shell of the van there is a 2 in. space filled with glass fibre or expanded ebonite insulation, which is, however, pierced in a number of places by bolts and structural members. Only the walls and roof of the van are insulated, the floor being of wooden boards covered with asphalt. A number of drain holes are provided.

In addition to these modern vans there are a number of vans of an older type still in service. These have double walls with no insulation between them and do not have light alloy lining. Some of these vans have been modified to bring them wholly or partly up to modern standards. Where possible, daily fish traffic is carried in modern vans, although many of the older types are still in use.

It should also be noted that there is no question of precooling a van before use. At a fish dock

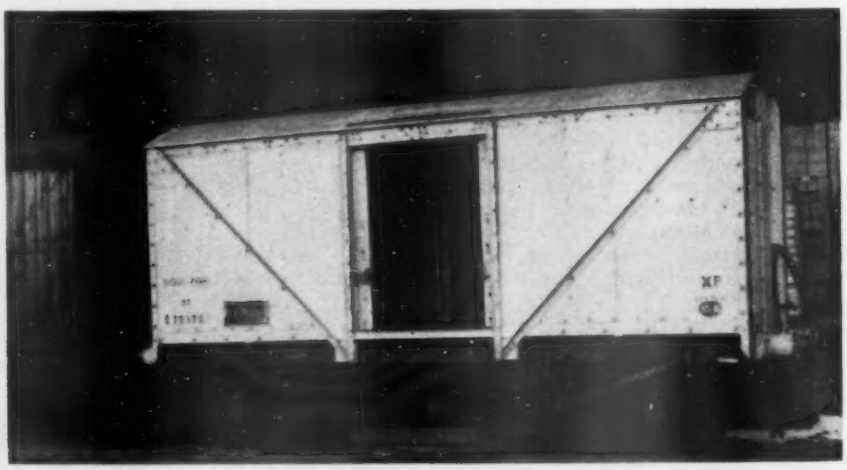


Fig. 3.

such as Hull, trains may be two or three abreast in the sidings, and it is often necessary to pass through one van to reach another. Access from the quayside to road vehicles may also entail passing through one or more fish vans.

It is also important to realize that these vans, unlike insulated containers for frozen fish, are not filled to capacity. Fish boxes are commonly stacked three, or at the most four, high and in a "full" van the floor would then be covered with boxes to a depth of only 3 ft. Shelves are provided at the ends of the van for carrying smoked fish, but this of course is not iced. A good average load would be 4 tons of wet fish and 1 ton of smoked fish. The demands of distribution are, however, such that many vans carry much less than this.

In a well-filled van we have a mass of fish, wood, and ice roughly 20 ft. × 7 ft. × 3 ft. From the point of view of heat transfer, the top and bottom of such a mass will be more important than the sides and edges. Now, the heat flow into the top may be prevented by covering the whole stack with a layer of crushed ice, provided that this layer is thick enough to last the journey. British Railways permit this practice, and indeed encourage it by making no charge for the carriage of such ice provided the quantity is within reasonable limits. In a modern van, 6 cwt. of ice used in this way is ample for a 10 hour journey in hot summer weather, and the cost of this at a major fish port could only be 6s. (0·12 pence per stone of fish). Spreading the ice over the load is the work of a few minutes. This practice of top-icing is not, however, very common, and its use is generally restricted to the larger firms who are sending one or more complete van loads to one destination.

Assuming that ice is placed on top of the load, the only boxes to be affected by heat flow from the outside will be the bottom layer. The top layer has ice above it and boxes of fish and ice below, while the middle layers have boxes below and above. True, the boxes at the sides and particularly at the corners of the load might be expected to receive some heat through the side and end of the van, but they are at least partially protected by cold water running over them from the melting ice above.

An attempt has been made to assess the heat flow into the bottom layer of the stack of boxes by placing weighed fish boxes full of ice into a typical load and weighing them again at the end of the journey. Although this experiment was rendered rather inaccurate by the melting of some of the ice between the time of weighing the boxes and loading the van (August, 1955, ambient temperature 78° F.) some useful information was obtained. In particular the experiment confirmed the belief that the greater part of the heat flow was in one direction only *i.e.* from the bottom upwards and that the flow from the sides and ends was relatively unimportant. The weight of ice melted in the boxes in the bottom layer suggested that the heat flow through the floor was of the order of 0·5—1 B.t.u./hr./ft²/°F. depending upon the assumption made regarding the cooling down of the structure. Since the wooden floor was some 2 in. thick the lower of these values would seem the more probable.

Following this work a study was made of the heat flow into an empty van. For this purpose two large boxes each capable of holding 200 lb. of solid carbon dioxide were placed in the van and supported about 2 ft. above floor level. Thirty thermocouples were placed at points on the inside and outside walls and temperatures measured over a period of 24 hours. The boxes of solid carbon dioxide were then refilled and measurements continued for a further 24 hours. Only results obtained in this second period, in which it was clear that conditions approaching equilibrium had been attained, were used in the final calculations. The van was in a covered goods depot and the variation of the ambient temperature was only 10° F. in the 24-hour period.

One experiment with a modern insulated van (built 1954) gave a total heat flow into the van of 180 B.t.u./hr./°F. or an average coefficient of 0·24 B.t.u./ft./°F. per ft.². A test a year later on a slightly smaller van of similar construction gave a total figure of 156 or 0·22 B.t.u./hr./ft.²/°F. If we assume that the walls and the floor of the van have over-all heat transfer coefficients of 0·15 and 0·5 B.t.u./hr./ft.²/°F respectively this would give a calculated average value of 0·23.

The older type of van was also included in these experiments. One built in 1922 had double walls with no insulation between them and also some small ventilators in the side walls. The equilibrium heat flow into this van was 310 B.t.u./hr./°F. a mean value of 0·57 B.t.u./hr./ft.²/°F. Another uninsulated van built in 1940 was also tested. This was slightly larger than the 1922 model and had no ventilators. It also gave an equilibrium heat flow of 310 B.t.u./hr./°F. corresponding in this case to an average value of 0·52 per ft.². These values also are roughly those which one would predict.

These experiments with stationary vans in a condition near to thermal equilibrium gave results which, while satisfying in their reproducibility and agreement with theory, are of very limited practical value. A fish van is warm when loaded and probably never gets into thermal equilibrium with its contents. Also it is difficult to ensure that a fish van, even of the modern type, will in fact remain airtight at all times and one would expect the heat flow into it to be considerably greater at 50 m.p.h. than when standing still.

An attempt was made to determine the heat flow into both old and new types of fish van when these formed part of a train travelling from Hull to London. The same technique was used save only that the thermocouples were attached to recording potentiometers of the electronic balance type. It was hoped that if these were carefully mounted they would operate satisfactorily in a moving train.

However, although the same instruments had operated successfully in heavy lorries[3] they were not able to withstand the shocks of shunting and both ceased to operate before the end of the run. Nevertheless some useful information was obtained from the rate of evaporation of carbon dioxide.

This showed that for both the old and the modern type of van the total heat leak was about twice as great when the van was running as when it was stationary. Reliable measurements of temperature gradient were only obtained in the uninsulated van and these gave a figure slightly less than half that of the static test. Hence it seems that in this case the over-all heat transfer coefficient between the inside and outside of the van was at least 4 times as great when running as when stationary.

One must, however, be cautious in applying these results for empty vans to vans loaded with fish. If the van is full the mass of boxes is compact and few draughts will blow through it, they will only affect the temperature in the air space above it. This will of course influence the amount of heat getting into the stack from the top, but as we have seen such heat can be dealt with by top icing. For example, temperature measurements on a van which had travelled from Hull to London with top icing showed fish temperatures in the range 34° to 39°F. and an air temperature in the van of 49° F. The ambient temperature was 62° F.

From this work there would seem to be little need for any modification to the fish vans themselves. It is understood that British Railways have considered the use of insulation beneath the floor, for this is clearly the weakest point in the thermal insulation, and vans with insulated floors are well advanced in the design stage. However, even this would not be very important if the fish boxes had ice at the bottom as well as the top, and such practice is clearly desirable both for cooling the fish and for providing thermal insulation in the later stages of distribution when boxes may be handled singly.

The charges for the rail transport of fish are based upon the estimated gross weight of the box, with fish and ice. Thus, there is a clear financial incentive for the merchant to use the minimum quantity of ice. Even if the basis of the system were altered and the merchant charged only on the weight of fish he would still be discouraged from using more than the minimum amount of ice since this would entail using more boxes for the same weight. It is the cost of boxes and not that of ice which is considered to be important. It is a pity that top icing of the stack of boxes which gives a considerable advantage at little extra cost is not more widely practised.

A further point which is worthy of attention is the use of solid carbon dioxide which is readily available at fish docks. Blocks of this material may be suspended in the van or broken up and scattered over the ice. The cooling effect of carbon dioxide at 32°F. is roughly twice that of ice (275 B.t.u./lb. cf. 144 B.t.u./lb.) but its price at the ports is some 50 times as great. Thus, it would seem more reasonable when dealing with wet fish to use a larger quantity of ice instead. This argument does not, of course, apply to smoked fish which must be kept dry.

The two important considerations in the problem of keeping fish cool during rail transport are (a) journeys are short, hence the problems are those of transient rather than steady state conduction (b) Ice at the ports is cheap (£1 per ton). Thus, the liberal use of ice in the correct places offers a far better prospect of getting wet fish to the consumer with the minimum deterioration and at the minimum cost than any modification to the rail vans themselves.

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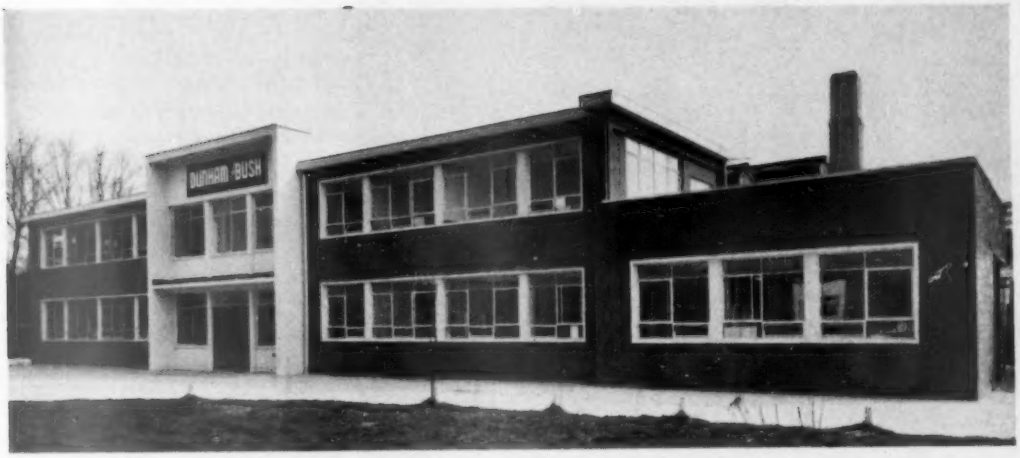
[2] NICOL, D. L. (1958). *J. Sci. Food Agric.* No. 2, pp. 78-82.

[3] NICOL, D. L., & LAWRENCE, J. (1956). *Modern Refrigeration* Vol. 59, p. 316.

The work described in this paper forms part of the programme of the Department of Scientific and Industrial Research. It was carried out in co-operation with the Research Department of British Railways.

ASTRAL ON ITV

Here, with TV quiz-king Michael Miles, is Mr. Bernard Harris of Sarisbury Green, Southampton. On Michael Miles's "Take Your Pick" top-rating TV show, which appeared on all national networks on Good Friday, Mr. Harris won a Morphy-Richards "Astral" Commodore refrigerator.

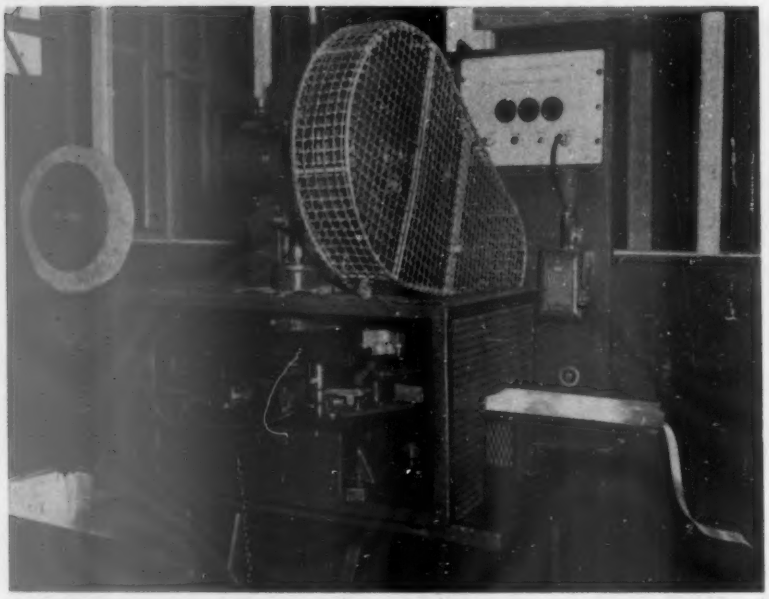


Dunham-Bush's Modern Plant at Portsmouth

OCCUPYING a dominant position on the Portsmouth ring road, on the Havant leg, the recently completed factory of Dunham-Bush Ltd. strikes a modern note with its facade bearing the internationally-known " D-B" monogram.

The Dunham-Bush Company was registered in England in January 1957, being known formerly as C. A. Dunham Co. Ltd. The new name was adopted following the amalgamation of the parent company in the U.S.A. with the Bush Company, coming under the control of the then president of the Bush Company, Mr. Cecil Boling.

General view of shops.



Press producing copper inner fin.

The Dunham Company was originally formed in the U.S.A. in 1903 and a few years later set up the Dunham Co. Ltd. in Canada. In 1919 a branch office of the Canadian company was opened in England and this was formed into an English company as a subsidiary of the Canadian company in 1929.

The Bush Company was formed in the U.S.A. in 1907, manufacturing heat transfer products.

The amalgamation of the two companies in the U.S.A. was completed in June of 1956 and the English company enjoyed a brief visit from the president, Mr. Boling, in September of that year, when it was decided that a fresh site should be found, and the existing site at Merton, London, be sold. In April 1958 Mr. Boling again visited England and selected an existing factory situated at Farlington, Portsmouth, as the new site, and by January of this year the Dunham-Bush Company was fully established and in operation in this building.

The Dunham Company has been concerned with the production of heating products whilst the Bush Company has been the producer of many cooling products, outstanding among which was the development of the inner fin, which has enabled considerable reduction in size of many heat exchangers.

The British company intends to develop most of the products manufactured by Heat-X Inc., a subsidiary in the U.S.A. of the Dunham-Bush Inc., and already some tooling has been completed and pilot runs on chillers and heat exchangers are now in operation.

Coiling the inner fin into the tube.

Later it is proposed to develop oil coolers, air after coolers, mufflers, super heat exchangers and remote air-conditioning units. It is also anticipated that there will be developments of products of the Brunner Division of the Dunham-Bush Inc.

Whilst the company is branching into cooling products, the manufacture of traditional lines will continue and such heating products as steam traps, vacuum pumps, condensation pumps, and various unit heaters will indeed be expanded.

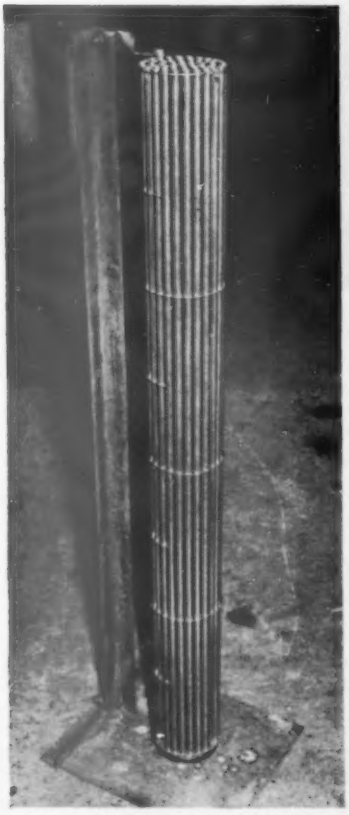
The present refrigeration production embraces liquid-suction line heat interchangers—models SX and RX, these being of the heavy duty type 7½ to 100TR capacity, and of all-steel construction ; direct expansion liquid coolers, suitable for most liquid cooling applications, including water, glycols, brines, etc. These are of non-ferrous construction and have built-in refrigerant distributors. Capacities range from 2 to 135TR (models CH) ; shell-and-tube condensers (model 1C) of non-ferrous construction handling duties up to 135TR.

The immediate future production will take in water-cooled and refrigerated air after-coolers (models W1A and R1A) of non-ferrous construction with capacities up to 1,340 c.f.m. (These will cool the air to within 10° F. of the coolant temperature) ; W1O, water-cooled oil coolers also of non-ferrous construction with capacities up to 40,000 lb. of oil per hour.

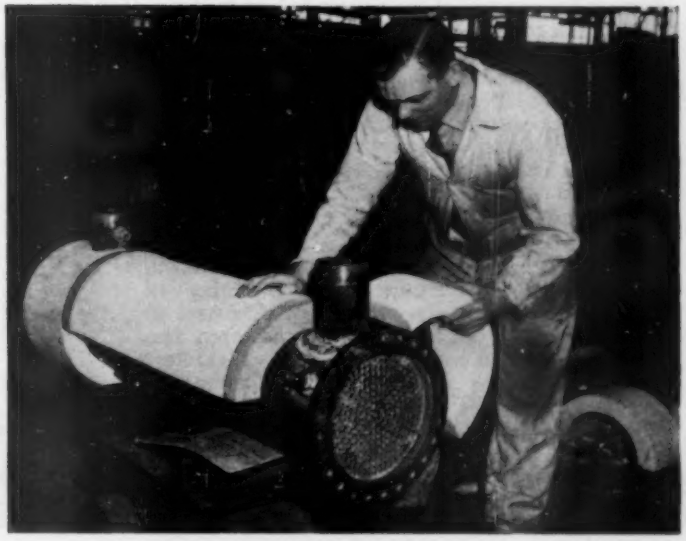
A later programme of production will cover oil separators (model OSM) and a range of cleanable shell-and-tube condensers.

The use of the patented D-B inner fin means that heat exchangers can be kept within very small dimensions for comparative duties and at a much lower cost. This type has been used extensively throughout the U.S.A. and other parts of the world for a great number of years.

British operations are ably administered by Mr. C. F. Assheton, managing director, who has on the refrigeration side of the business, Mr. J. S. Cohen, sales manager, Mr. G. V. Hattin, technical engineer, and Mr. E. Newitt, works manager.



Complete tube bundle of size for a water chiller.



Insulating large flanged chiller size CH 1118-48.

Photographed in the managing director's office: right to left: Mr. C. F. Assheton, Mr. E. Newitt, Mr. G. V. Hattin, Mr. J. S. Cohen.

INGENUITY PAYS

IN one of the rapidly expanding suburbs of Oxford, stand the premises of Webertons Ltd., a comparatively new company which has, quite naturally, been installing all that is the latest in the way of equipment in their combined grocery and butcher's shop in Cowley Road, Littlemore. It is arranged on the lines of a small supermarket, but here, as it is not so large, the personal touch is readily apparent and besides self-service, customers can order their goods in the usual way through the assistants, and even have orders delivered to their homes.

Looking in the butchery section window of the shop on one day there is what appears to be an ordinary refrigerated display case, attractive in itself, being well dressed and presenting a sparkling inducement to customers. Seen on another day, however, this counter appears to have been moved back so that customers can move around it and inspect the contents, and at first one is surprised that such an effort has been made. Upon closer examination though you would discover that what is in effect a solid, heavy refrigerated counter, can be moved about with the minimum of effort and the advantages to the butcher, or indeed any retailer, become readily apparent. The display case can be used in any position over a wide area and is moved to suit the requirements of the butcher. It facilitates easy cleaning and makes loading and unloading a simple process, in addition to which, should it be required in a different part of the shop or even on different premises, this can easily be arranged.

This novel idea was conceived by the management and the Southern Electricity Board of Oxford and is self-contained, the only connexion needed being an electrical point. The easy movement is effected by six rubber-tyred castors and handles on the back of the cabinet. A self-contained drip tray is mounted in the front of the counter whilst the easily-accessible Prestcold $\frac{3}{4}$-h.p. condensing unit is situated in one-half of the space underneath.

It is logical that, having a refrigerated display at the front of the shop, the equally important storage of meat be catered for. A Prestcold 350-c.ft. cold room operated by a $\frac{1}{2}$-h.p. unit complete with the Prestcold Defrostermatic automatic defrosting system is installed which, for a busy establishment like Webertons is a very necessary and valued piece of equipment.

Recent Progress in Refrigeration

By U. RITTER, G. SCHOBERTH and E. EMBLIK*

After a brief historical introduction, the practical and economic aspects of refrigerating plants using oilfree labyrinth-piston compressors are discussed. These machines, which require no cylinder lubrication, have been employed over a period of 20 years for the delivery of gases without oil contamination, and in recent times the same principle has been successfully applied to refrigerating compressors. Some reference is made in conclusion to the use of " Freon " turbocompressors for large refrigerating installations.

REFRIGERATION was first used for commercial purposes in Switzerland in the seventies of the past century. The first Sulzer refrigerating plant, comprising an ammonia compressor driven by a steam engine, was put into service in the Nestlé condensed milk factory at Cham in 1878 (fig. 1). Since that time refrigeration engineering has grown steadily in importance and has found applications in almost all branches of trade and industry ; and there are no signs as yet of this development coming to a standstill.

Throughout this period of industrial advance the piston-type refrigerating compressor has held its own in the small and medium capacity range. The piston-type compressors in general use require an efficient lubricating system for bearings and cylinders if they are to operate satisfactorily. Cylinder lubrication, however, involves certain features which adversely affect the economy of operation.

Oil Circulation in the Refrigerant Circuit

It is obvious that some of the oil used for cylinder lubrication, since it comes into direct contact with the refrigerant, will be entrained into the refrigerant circuit. A certain amount of this oil can be removed and returned to the compressor by the use of oil separators, but there is no method of preventing such oil entrainment completely. It is also well known that the oil which thus finds its way into the refrigerant circuit is a liability, since it may cause operating troubles and impair the economy of the plant.

Thus the oil may form a film on the inside walls of heat exchangers and thereby reduce the transfer of heat. It may also collect in pipes and evaporators, blocking the refrigerant circuit, forcing the refrigerant out of the evaporators and consequently obstructing the evaporation process.

The effects of the entrainment of lubricating oil in refrigerating installations are well enough known to the plant engineer. They differ in ammonia and " Freon " plants, since these refrigerants react to the oil in different ways. Thus oil is for practical purposes insoluble in ammonia, while it will dissolve in any proportion in " Freon-12."

The reduction of output due to the formation of an oil film in the evaporators and condensers of ammonia plants under normal operating conditions takes the form of a decrease in the coefficient of heat transmission of the units. If this coefficient is k_o for tubes free of oil and k for tubes carrying an oil film, the ratio k/k_o is a measure of the deleterious effect of the oil film on heat transmission.

In figure 2 this ratio is plotted as a function of the coefficient of heat transmission k_o for various film thicknesses. It will be seen that the unfavourable effect of an oil film becomes more pronounced as the coefficient of heat transmission of the clean equipment rises.

If a unit is to attain the same performance in spite of a reduction in the coefficient of heat transmission, the temperature difference must be increased. This means that an evaporator with oil-covered tubes must be operated at a lower evaporating temperature than if the tubes were free of oil, in order to attain

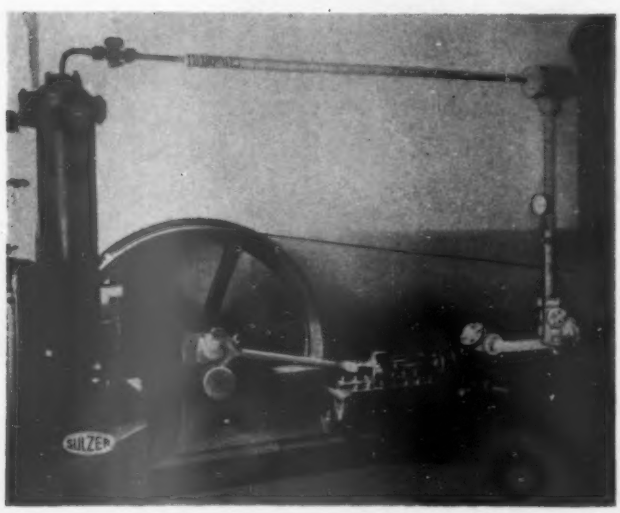
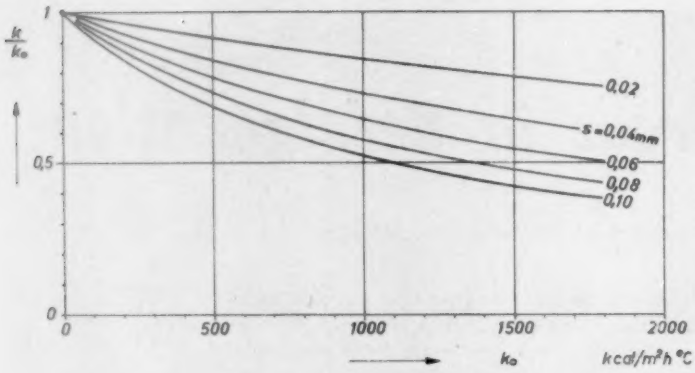


Fig. 1.—Sulzer ammonia refrigerating compressor installed in the Nestlé condensed milk factory at Cham, Switzerland, in 1878.

* *Sulzer Brothers Ltd., Winterthur ; published in Great Britain by collaboration with this firm of refrigerating engineers.*



$$\frac{1}{k} = \frac{1}{k_o} + \frac{s}{\lambda}$$

Fig. 2.—Effect of an oil film on the coefficient of heat transmission.

k_o = Coefficient of heat transmission without oil film.

k = Coefficient of heat transmission with oil film.

$$\frac{1}{k} = \frac{1}{k_o} + \frac{S}{\lambda}$$

S = Thickness of oil film.

λ = Thermal conductivity of oil = 0.11 kcal./m/hr/°C.

the same brine temperature. As the refrigerating performance of a compressor decreases much more markedly than the power requirements as the evaporating temperature is lowered, the result is uneconomical operation.

It is of course possible to operate an evaporator with oil-covered tubes at the same evaporating temperature as is employed with clean tubes, but in that case the cooling surface should be increased in the ratio k_o/k, which involves additional expenditure.

In a condenser the liquefying temperature rises as soon as an oil film forms on the tubes. This leads to an increase in the power requirements of the compressor. If the same condensing temperature is to be retained with oil-fouled condenser tubes, the condensing surface must be enlarged in a ratio of k_o/k, which again entails extra expense.

It is only in air coolers, where the coefficient of heat transmission is fairly low, that the effects of an oil film are of small importance.

The reduction of output due to the presence of lubricating oil in the circuit, however, is found in practice to have less effect on economy than the operating troubles caused by the undesirable accumulation of oil in the system. Such troubles are particularly frequent in plants in which the piping system is wrongly dimensioned or has been badly laid.

Oilfree Compressor

The need for some method of delivering gases without exposing them to oil contamination was felt in certain industries at a very early date. Great interest was therefore aroused in compressor circles when Sulzer Brothers placed a dry-piston compressor on the market in the middle 1930s. The essential feature of this machine was the sealing of the piston in the cylinder and of the piston rod in the stuffing-box by means of labyrinth action, without there being any contact between the parts. The piston runs in the cylinder without either friction or lubrication, so that the gas handled cannot be contaminated by oil and remains as pure as before compression. This oilfree compressor is now in wide use in breweries and soft-drink factories, in the chemical industry and in steelworks, in fact wherever oilfree gases are required. A field of particular interest is the compression of oxygen.

From the purely theoretical viewpoint it might seem a very small step from the oilfree gas compressor to the oilfree refrigerating compressor. In practice, however, it proved that a completely new design was required to allow for the properties of the refrigerant vapours, to provide complete sealing against losses, etc., if the oilfree refrigerating compressor was to meet all the requirements of commercial operation.

A number of oilfree refrigerating compressors have now been running in Switzerland for some years and have fulfilled all the hopes placed in them (fig. 3).

The Problem of Labyrinth Losses

The first task which confronted the designers of these compressors was to determine the order of magnitude of the blow-by losses around labyrinth pistons. Systematic tests showed that these depended less on the form than on the number of the throttling points.

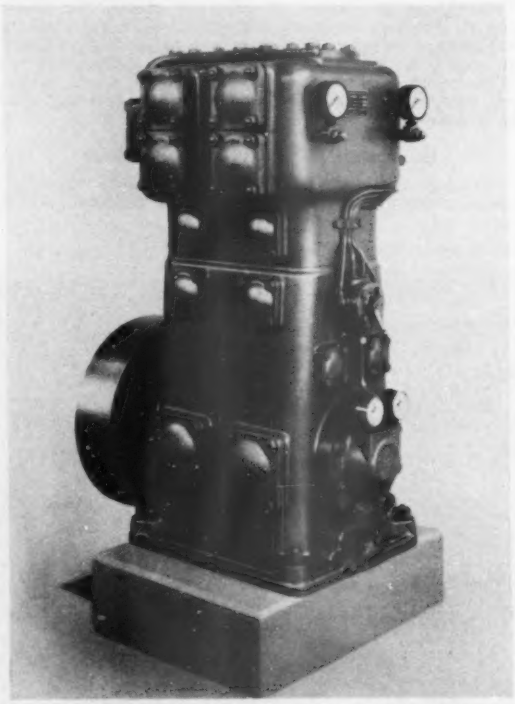
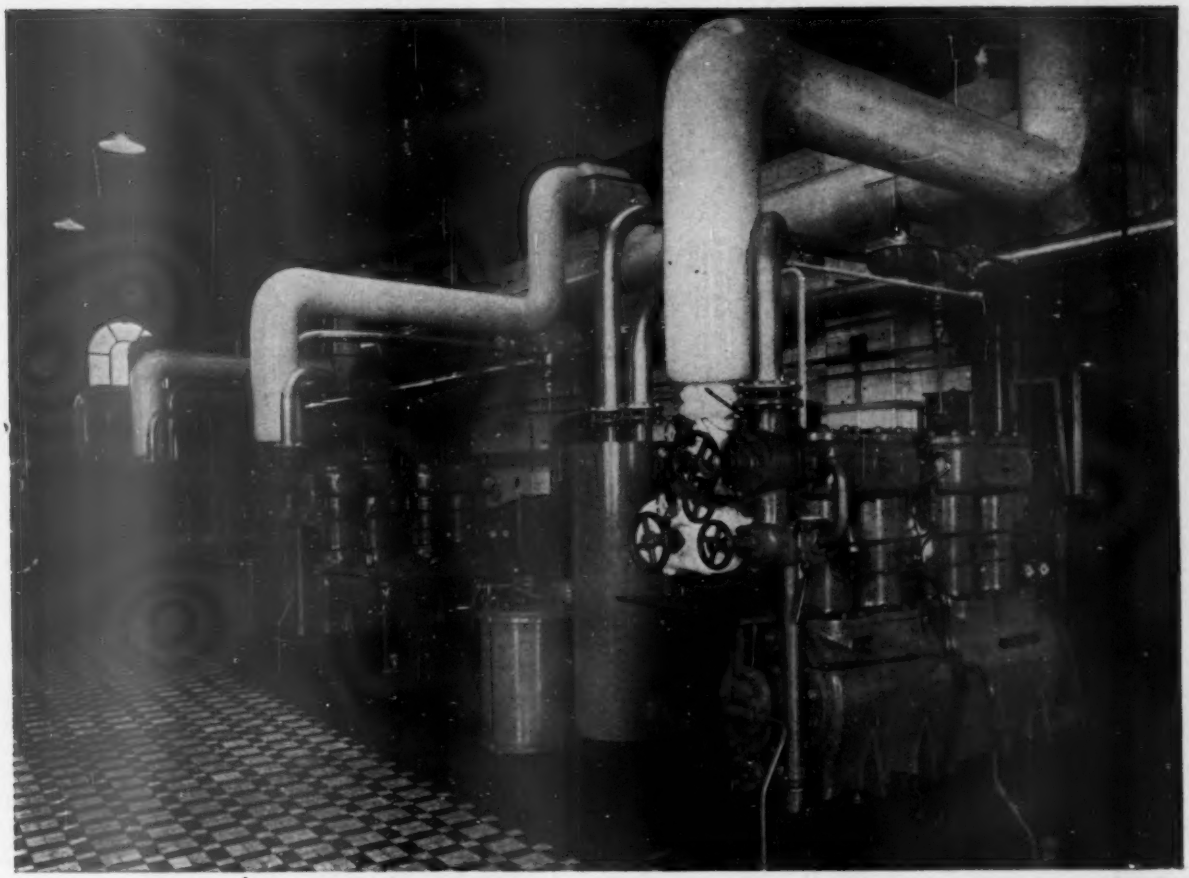


Fig. 3.—Oilfree refrigerating compressor for 310,000 kcal. (or 1,230,000 B.t.u.) per hr., single-stage double-acting design. The crankcase is closed to prevent losses of refrigerant.



Refrigeration

Refrigerating compressors of the monobloc type are widely used in the manufacture and storage of foodstuffs. This installation comprises four 8″ x 8″ quad and an 8″ x 8″ twin monobloc compressor, driven by a total of 675 h.p., and have an installed capacity of 6½ million B.t.u. per hour. It is installed at the margarine plant of the Co-operative Wholesale Society at Irlam, Manchester. The equipment manufactured by J. & E. Hall ranges from small refrigerated cabinets and compressors of ¼ h.p. to centrifugal compressors of the largest size in use today.

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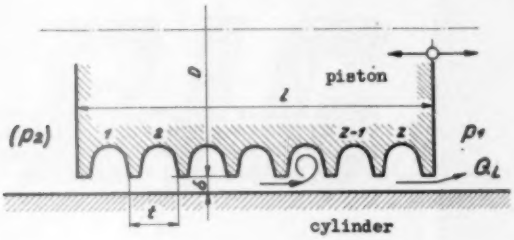
Stodola, well known for his work on steam turbines, had already set up a formula for the flow of gas through a labyrinth. By applying this relationship to the special case of the oilfree compressor, Hänny of Sulzer Brothers Limited calculated the



$$v_L = \frac{Q_L}{Q_H} = \frac{\varphi}{\sqrt{z}} \cdot \frac{a_1}{c_m} \cdot \frac{\delta}{D} \cdot \frac{p_2}{p_1}$$

$$\varphi = \varphi\left(\frac{\delta}{t}, \frac{p_2}{p_1}, \epsilon, \varkappa\right)$$

$$z = 1/t$$

$$a_1 = \sqrt{\varkappa g R T_1}$$

$$c_m = \frac{s \cdot n}{30}$$

Fig. 4.—Diagram of a labyrinth seal. A—Piston; B—Cylinder; l—Length; D—Diameter; p—Instantaneous pressure in cylinder; p_1, p_2—Pressures in suction and discharge pipes; 1, 2—Number of labyrinths.

labyrinth loss figure v_L by means of formula (2).[1] This figure is the ratio of the labyrinth loss Q_L to the theoretical discharge Q_H (see fig. 4) :

$$v_L = \frac{Q_L}{Q_H} = \frac{\xi}{\sqrt{z}} \cdot \frac{a_1}{c_m} \cdot \frac{\delta}{D} \cdot \frac{\delta p_2}{p_1} \quad \ldots\ldots\ldots\ldots (2)$$

where

Q_L = labyrinth loss,

Q_H = theoretical discharge,

u = $u\left(\frac{\delta}{t}, \frac{p_2}{p_1}, \epsilon, \varkappa\right)$, coefficient of shape,

z = $1/t$, number of labyrinths,

a_1 = $\sqrt{\varkappa g RT_1}$, speed of sound in suction pipe,

c_m = $\frac{s \cdot n}{30}$, mean piston speed,

p = instantaneous pressure in cylinder,

p_1, p_2 = pressures in suction and discharge pipes respectively.

It appears from this that the relative labyrinth losses depend on a coefficient of shape **u**, which takes account of piston clearance, shape of labyrinths and indicator diagram ; on the number of throttling points z ; on the ratio of the speed of sound in the suction pipe a_1 to the mean piston speed c_m ; on the ratio of the radial piston clearance to the piston diameter ; and finally on the pressure ratio in the compressor stage under consideration.

It is clear from equation (2) that the losses become smaller as the piston speed increases, so that machines running at high speeds are at an advantage. As there is no friction between piston and cylinder, the speed is limited only by the stressing of the material as a result of the forces of inertia and by the design of the valves.

Since the ratio of piston clearance to piston diameter $\left(\frac{\delta}{D}\right.$ in equation 2) remains practically constant or at least changes only very little with changing cylinder diameter, machines of identical design can be constructed for large or small discharges. The equation also includes the pressure ratio only, and not the absolute pressure, so that in theory at least the losses do not increase with rising pressure.

One of the main practical problems was efficient oil scraping on the piston rod. It is essential that no trace of lubricating oil should make its way from the crosshead or the upper guide bearing along the piston-rod surface and into the cylinder. A great deal of development work was necessary before this requirement could be satisfied.

Another feature which represented a major problem was the unlubricated stuffing-box, which must not come into contact with the piston rod. Graphite rings with labyrinth grooves were here found to offer the best solution.

The choice of the clearance between piston and cylinder was also a point of paramount importance and was of course affected by factors such as design, cooling, material used and working conditions. Extremely strict demands were made in respect of the machining of these parts, since the piston clearance is only a fraction of a millimetre even in large machines and must be uniform around the whole circumference.

Output Control

Very few refrigerating machines operate at constant load. The demand usually fluctuates within more or less wide limits, according to the nature of the plant. The adaptation of the output to the requirements by a control system involving the very minimum of losses is consequently often a matter of cardinal importance for plant economy. The same basic methods of control can be adopted with the oilfree compressor as with the lubricated machine :

(*a*) *Speed control* : If a compressor can be driven by a machine equipped with infinitely variable speed adjustment, this constitutes an ideal method of output control. Economical control is also possible in many cases with pole-changing motors or belt drives incorporating interchangeable motor pulleys.

(*b*) *Timed suction-valve control* : This method is as simple as it is economical. It is based on the variation of the period during which the suction valves remain open.

(*c*) *Control by intermittent operation* : In multi-cylinder compressors one or more cylinders can be put out of action by keeping the suction valves raised. This method is particularly suitable for oilfree compressors. In lubricated piston-type compressors it involves the danger of a simultaneous interruption of cylinder lubrication, which may well cause operating troubles that are precluded in the oilfree machine.

(*d*) *Control by throttling* : This is a simple method and is cheap to install, but is not economical in operation.

(*e*) *Control by clearance spaces* : While the clearance space is usually kept as small as possible in reciprocating machines in order to secure the maximum output, in this case artificial clearance spaces are connected to the cylinder either in succession or continuously. This method has been widely adopted, especially for the regulation of refrigerating compressors.

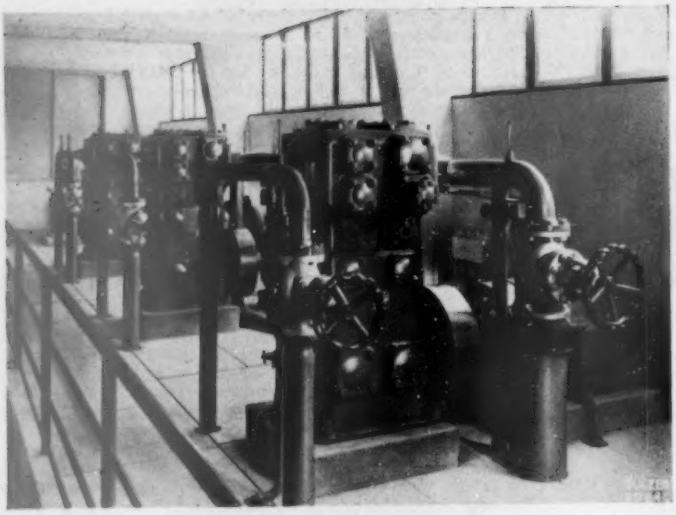


Fig. 5.—Oilfree refrigerating compressors installed in the Winterthur open-air ice rink, Switzerland. The machines are of two-stage double-acting design.

Fields of Application

Oilfree refrigerating compressors can be adopted wherever the conventional types are used. At present they are manufactured in series both in single-stage and multi-stage versions, but only for fairly large outputs (fig. 5).

An application in which the oilfree compressor is at a great advantage is continuous deep cooling at evaporating temperatures below –40° C. The pour point of the lubricating oils commercially available is normally above –40° C. When the evaporating temperature is below this figure, the accumulation of solidifying lubricating oil in the evaporators is therefore inevitable in the course of time, with the result that cooling is impaired and may break down altogether. In air coolers for deep-cooling installations, which have to be de-iced from time to time, the oil can be removed during the thawing process, so that lubricated compressors can here be used. It is clear, however, that even in these cases the oil will always represent a potential source of trouble.

The trend of present-day developments shows that the chemical and allied industries are likely to make ever-wider use of low temperatures for their special processes. The oilfree compressor and its working characteristic here offer a reliable and efficient solution to the problems presented by refrigerating plants operating at very low temperatures.

Turbocompressors for Large Cooling Plants

As trading, industrial and insurance enterprises increase in size, they naturally require new and larger administrative and office buildings. Since rising standards and bigger volumes of work at the same time make higher demands on the personnel, it has also become essential to improve working conditions as a means of boosting the performance of the individual.

One of the most important factors contributing to healthy and pleasant working conditions is the provision of good air at comfortable temperatures. For this reason many offices and industrial buildings, as well as hospitals, are to-day air conditioned. There is also a tendency to place power stations, vital industries and military structures underground or in rock shelters, and here air-conditioning installations are indispensable. As a rule they require a good deal of refrigeration, which must be provided by plant taking up very little room and operating without causing noise and vibration. The turbocompressor has proved to be the ideal unit for this purpose. "Freon" is used without exception as a refrigerant, and the plants are built in the form of packaged units with condensers and evaporators connected by the shortest possible refrigerant piping. Cooling is always done through a secondary medium such as water or brine, which is pumped in a closed circuit to the points of consumption. High-speed electric motors are used for driving the compressors, while in industrial plants steam turbines may also be adopted. The steam turbine offers the advantage of direct coupling to the high-speed turbocompressor, while with electric motors gearing is used. Plants of this kind are to-day being installed in large numbers for the air conditioning of banks, warehouses, offices and industrial buildings.

[1] Paper read at the 16th Colloquium of the Dechema Institute at Frankfort-on-the-Main, February 10, 1956.

Correct Food Display.—In the new Premier Supermarket at Croydon customers can shop in comfort in all weathers and the carefully controlled temperature helps to ensure that food on sale remains in prime condition. The equipment for this purpose was designed and installed by Norris Warming Co. Ltd. who have made a special study of the conditions in open-counter shops, where it is desirable to avoid obstructions in the floor space which would impede the efficient handling of goods. The plant is so designed as to be readily adaptable for full air-conditioning, using refrigeration should this be deemed advantageous at a later date.

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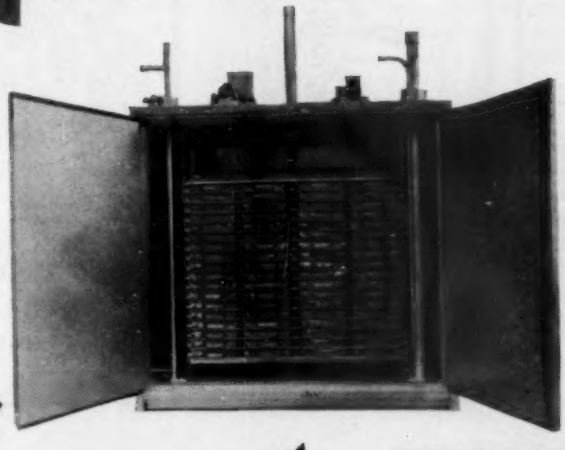

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OFFICES FOR YEAR 1959-60
THE EXECUTIVE COUNCIL

Mr. G. L. H. Bird, Mr. J. A. Stonebanks and Mr. T. Telfer, corporate members, and Mr. E. W. Burman, associate, have been elected to fill the vacancies on the executive council caused by the retirement, under by-law 10, of Mr. C. M. Brain, Mr. K. J. R. Cocke and Colonel H. Randal Steward, corporate members, and Mr. S. B. Turner, associate.

The members of the executive council for the year March 26, 1959, to March 25, 1960, are :—

President

Sir Rupert De la Bère, Bt., K.C.V.O.

Sir Rupert De la Bère who occupies the presidential chair for the second year.

Past-Presidents

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John Archer Stonebanks
James Charles Taylor
Thomas Telfer, B.SC. (Eng).

Honorary Treasurer

At a recent meeting of the executive council, Mr. T. A. Raymond was re-elected honorary treasurer of the Institute for the year March 26, 1959, to March 25, 1960.

INSTITUTE PRIZES

The executive council has decided to award the first and second Institute prizes for work on the 1957/58 refrigeration diploma course at the National College for Heating Ventilating, Refrigeration and Fan Engineering to Mr. B. C. Oliver and Mr. J. R. D. Kidd respectively.

PADUA INTERNATIONAL FAIR

Cold Storage Conference

The Padua International Fair will be held in Italy from May 30 to June 14, 1959.

The executive committee of the fair announces that, in co-operation with the Italian Cold Storage Association, the Centre of Studies for the Applications of Refrigeration of the National Council of Research at the Padua University, the Milan Cold Storage Experimental Station, and the Cold Storage Machinery Manufacturers' Union, the 8th National Cold Storage Conference will be held in Padua from May 31 to June 2.

Further details may be obtained from the secretary of the conference, Via N. Tommasseo 59, Padova, Italy.

MARCO'S NEW MIDLANDS CENTRE

DESCRIBED as "the finest refrigeration centre in the Midlands," magnificent new showrooms, extensive warehousing facilities and a servicing bay were opened last month in Nottingham by Marco Refrigerators Ltd.

The premises were formerly the Commodore Cinema and their conversion to the new use could well serve as a model in the commercial refrigeration field.

Mr. Jack Burkitt, captain of Nottingham Forest Football Club, together with other members of the team, officially opened Commodore House. The ceremony took place at midday and was attended by 200 official guests, among whom were many well-known local personalities and representatives of many important concerns having national coverage, including frozen food processors, as well as local tradesmen.

Commodore House is situated in Nuthall Road, just a short distance from the heart of Nottingham. This new Marco branch incorporates a large warehouse (the former auditorium) and fully equipped service centre (the stage). The showrooms (the

(*Continued on page 479*)

Above: The front of the showrooms has been finished in most attractive mosaic. Right: the former cinema foyer makes an ideal showroom.

REFRIGERATION BY WILLIAMS

Part of the low temperature refrigeration plant installed for Messrs. Eskimo Foods Limited, Cleethorpes, Lincolnshire

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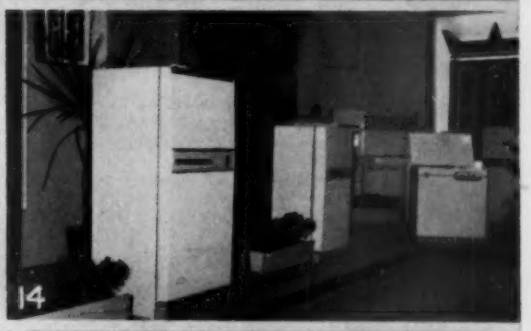
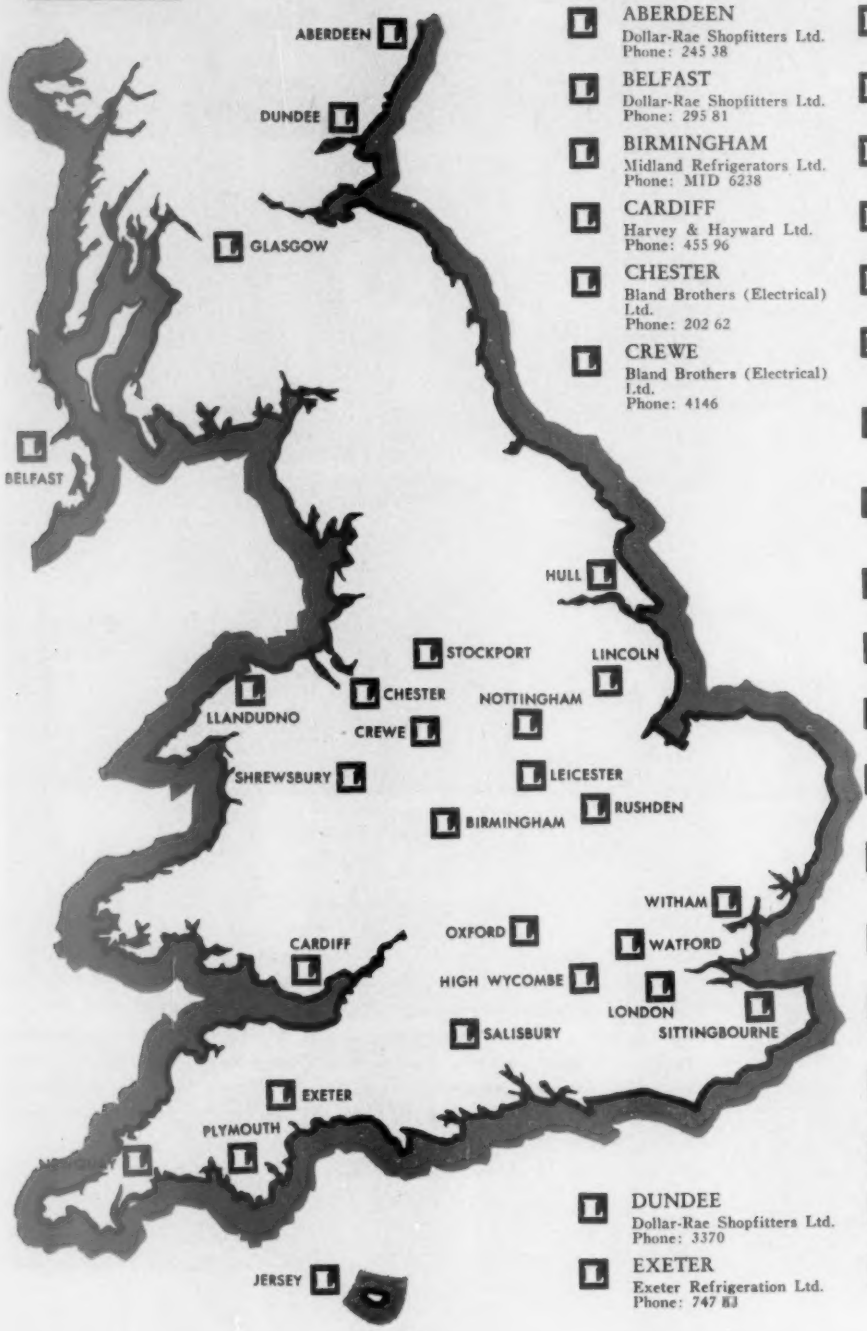
MILAN TRADE FAIR, 1959

1—"Il Lavoro" ("work") typifies the spirit of the exhibition. 2—Entrance to commercial refrigeration building. 3—Rappresentanze Estere Industriali—wide range of Sternette plant from Britain. 4 and 6—Refrigerazione Automatica Moderna S.r.l.—Agents for Marco—cases and cabinets of their own construction. 5—S.A.M.I.F.I.—Macchinari Impianti Frigoriferi Industriali S.p.A.—Block-ice-making and crushing in small area. Children consume the chips. 7 and 8—Barbieri-Costruzioni Meccaniche S.r.l.—Industrial refrigeration plant and block ice-maker. 9—Stempel-Hermetik G.m.b.H., Germany, range of fully- and semi-sealed units. 10—Dell'Orto Ing. Giuseppe Officine Mechaniche—the largest stand—a wide range of commercial and industrial plant.



11—The Engineering Pavilion. 12—York Corporation, New York—room conditioners and 23,000 frig./hr. semi-central system conditioner. 13—Societa per l'Industria dell'Ossigeno e di Altri Gas—Industrial oxygen and other gas network in Italy. 14—Rex-Rotary Italia—perhaps the best styled Italian refrigerator. 15—Soc. Toscana Industria Cucine Economiche—one of the leading Italian makers of domestic refrigerators. 16—General Motors Suisse, S.A.—show included the magnificent "lace-work finish" 14 c.ft. model. 17—Neowatt B.C.—Agents for Prestcold refrigerators.

This is LEVIN



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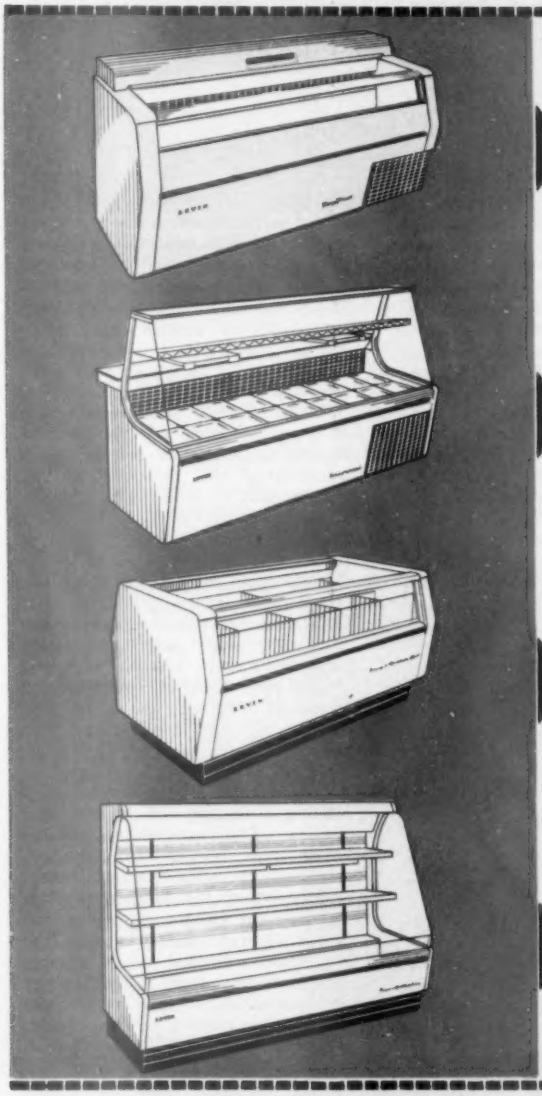

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FRYS-O-MATIC GONDOL, which is manufactured in three sizes, has a fan-assisted freezing system with fully automatic defrosting—like all cabinets of the FRYS-O-MATIC series. The GONDOL-type, however, has a great capacity and is your *best salesman of frozen foods.* This cabinet is also provided with a night-lid of transparent plastic. Delivery comprises condensing unit for remote installation.

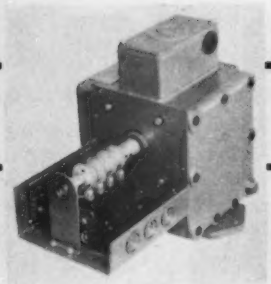
KYL-O-MATIC, the cooling counter with full customers' vision built for profitable sale of dairy products and all kinds of pre-packed eatables.
With fan-forced air circulation maintaining a uniform temperature of 38/42° F., shelves adjustable in height and inclination, sloping mirror behind the top shelf and fluorescent lamps—the Kyl-O-Matic is the ideal wall cabinet for self-service shops and Super-Markets. In 2- and 3-decker models—each available in three lengths.

IN STEEL WITH STYLE
for hygiene, efficiency and profit

LEVIN
PRODUCTS

Commercial and Industrial Section

MANUFACTURERS' AND DISTRIBUTORS' NEWS



See cols. 2 and 3—Thermocontrol.

Two views of the new factory at Thetford.

The G. Williams Engineering Co. Ltd., of London, announce they have recently concluded negotiations with Grasso Machinefabrieken N.V., of Holland, for the sole representation in the United Kingdom of the Grasso range of industrial and commercial refrigerating equipment. The G. Williams Engineering Co. Ltd. are well known as manufacturers of the popular Williams contact plate freezer and, in addition, manufacture industrial heat exchangers, extended surface tube, pressure vessels, fabricated steel pipework, coils, and platework for the refrigerating, chemical processing and food manufacturing industries. The firm of Grasso Machinefabrieken N.V. was founded in the year 1858 and has become one of the largest producers of refrigerating plant in Europe. Their range of compressors, designed for either ammonia or hydrocarbon refrigerants, extends from 7½ h.p. to 220 h.p. in single units and the machines come in either single-stage or compounded versions. This agreement, effective from April 1, 1959, together with greatly improved and extended manufacturing facilities now nearing completion, enables the G. Williams Engineering Co. Ltd. to offer a more complete and competitive range of equipment for all cooling applications and this is backed by an over-all design, manufacturing and erection service for complete refrigerating installations of all types and sizes.

* * *

A three-and-a-half million dollar microwave communication system for the United States Air Force in Great Britain will be protected from the effect of humidity, condensation, and overheating, by thermocontrol automatic heating, cooling and dehumidification controls. **Thermocontrol Installations Co. Ltd.,** London, will install hermetically sealed refrigeration units with automatic control by modulating thermostats as well as high-limit humidity control, for the semi-trailer vehicles. Each unit will contain hermetically sealed motor compressors, refrigeration condensers and evaporators, with propeller fans and air heaters. All equipment will be controlled by thermostats and humidistats. A unique feature of the Thermocontrol equipment is their system of interlinking the de-humidification, heating and cooling controls in the specially designed control panel, avoiding overrun and waste of power. The control system will include a TIC step controller (illustrated above) for graduated and sequential control of the electrical heater batteries and refrigeration condensing units. It incorporates a shaded-pole reversing motor, which transmits its power through a gear train to the final drive shaft. This rotates a cam-shaft providing sequential operation of a series of micro-switches, automatically controlling a battery of heaters and coolers. The humidistat—HF3—is being used because of the high sensitivity of its control mechanism. Composed of 150 strands of hair, the element causes control action at the slightest change in humidity. An exclusive tension device prevents the hair strands from being damaged by mechanical strain. Accurate temperature control in the vehicles is ensured by the TZP thermostat, a vapour-pressure type controller having throttling band adjustment in addition to the main setting. The necessary communication system will be supplied by Marconi's Wireless Telegraph Co. Ltd., the Automatic Telephone and Electric Co. Ltd., and the Telephone Manufacturing Co. Ltd.

Recently twenty students from the National College of Heating, Ventilating, Refrigeration and Fan Engineering, had a conducted tour round the works of **Teddington Refrigeration Controls Ltd.**, at Sunbury-on-Thames, when they had the opportunity of seeing first-hand—from the raw materials stage to the finished product—the numerous operations associated with the manufacture of the wide range of Teddington instruments supplied to the refrigeration industry. After tea in the executives' dining room, Mr. Stephen S. Sherlock, sales director, gave a short talk in which he particularly stressed the importance of after-sales service. Great interest was displayed by the students, many of whom came from overseas. They were accompanied by Mr. R. W. Webb, senior lecturer, and Mr. F. J. Hagger, lecturer in refrigeration at the National College.

* * *

Marco Refrigerators Ltd's Italian representatives, R.A.M. of Milan, report that "Serviseal" units have been fitted in 17 large Italian liners lately; in total, 158 of these semi-sealed units have been installed in major ships including vessels of the well-known Lloyd Triestino Line.

* * *

The address of **Airpak Ltd.**, is now 19, Berkeley Street, London, W.1., the telephone number remaining unchanged at Mayfair 3467.

H.R.P.'s Convenient and Spacious Premises

These photographs, specially taken by "M.R.", show how the King's Road, Chelsea, London, premises of H.R.P. Limited, refrigeration and heating equipment suppliers, have been extended and improved in recent months. H.R.P.'s own transport serves most of the main towns in England and Wales while the firm has its own factory at Bury St. Edmunds for the manufacture of fittings, valves and dehydrators. H.R.P. are official stockists for Teddington Refrigeration Controls for whom they carry a comprehensive range. Mr. F. W. Curtis, managing director, has a very efficient team with him. Mr. H. E. Richiardi is always available to aid customers with any queries they may have while Mr. L. S. Goodger is at all times ready to visit customers to discuss any problems that need urgent attention.

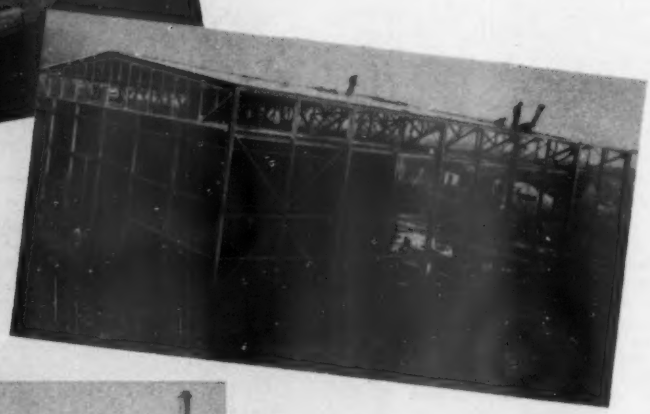
(Continued on page 478)

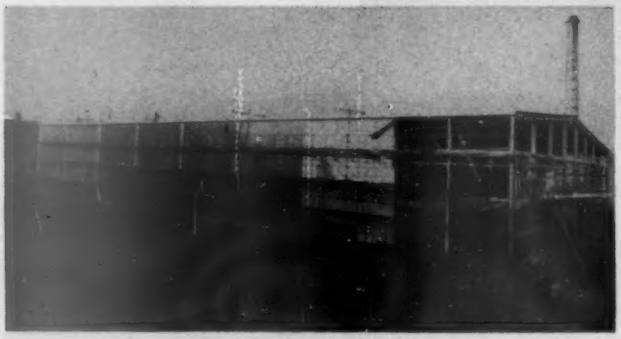
A view of the main office.

Built in only 13

Progress after 1 week

Progress after **2** weeks





Progress after **7** weeks

Photographs by courtesy of T. Wall & Sons (Ice Cream) Ltd.

Whether you want a small sectional store or a massive 1,000,000 c.ft. storage depot, we can handle the whole contract from the basic designs to the completed store. Our experience in the design and construction of cold stores of *any* size and unique construction techniques give you low running costs, easy operation, and speedy completion.

H.R.P.'s despatch department.

Section of stores showing range of Teddington Refrigeration controls, etc.

Loading goods for London delivery.

Some cooling coils available from stock at Chelsea.

MARCO'S NEW MIDLANDS CENTRE

(*Continued from page* 468)

erstwhile foyer) are situated on three levels and are claimed by Marco to be the finest refrigeration showrooms in the Midlands. They are arranged to give a permanent exhibition of Marco products. Commodore House is visible for many miles around Nottingham and the building will be eventually surmounted by a large neon sign. The branch can be easily reached from all parts of the country and a large private car park ensures safe and convenient parking space.

The appearance of the frontage has been enhanced by large showroom windows and a mosaic pattern surround. This Nottingham branch will provide facilities to give better service to clients than ever before and will also be of great assistance to Marco's Midland distributors.

The restaurant in this building, although not operated by Marco's, is a great asset to the firm as visitors can be so easily entertained " on the spot."

At the opening ceremony were Mr. R. J. Simpson, managing director, and Mr. E. A. Leach, director, from Streatham.

Mr. R. J. Simpson, managing director, third from left, Mr. E. A. Leach, secretary and director, extreme right, Colonel J. D. Young, sales manager, second from left, Mr. T. W. White, local manager, left, with the captain and three members of the Nottingham Forest team at the opening ceremony.

HEALTHY CIRCULATION

for the life-blood of refrigeration

Compact design, easy access for maintenance, simple, low-cost installation and long, trouble-free service with the minimum of attention —these features make Worthington-Simpson pumps the ideal choice for brine and water circulation and other refrigeration duties.

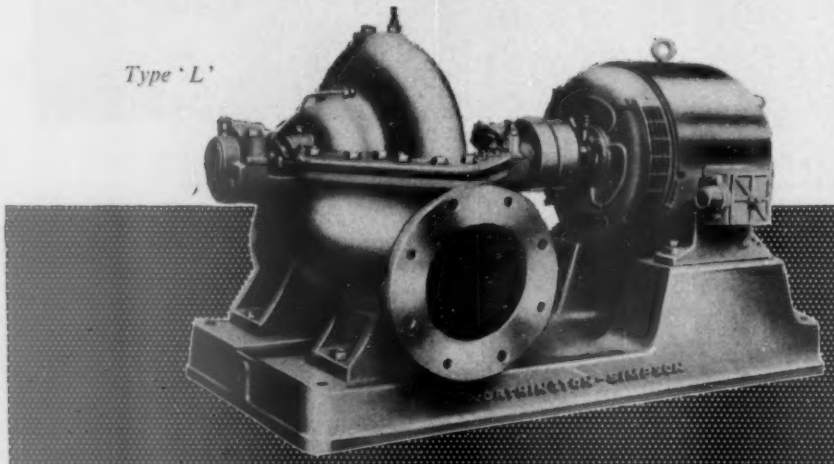
W|S refrigeration pumps include:

Single and two-stage volute pumps of split case construction.

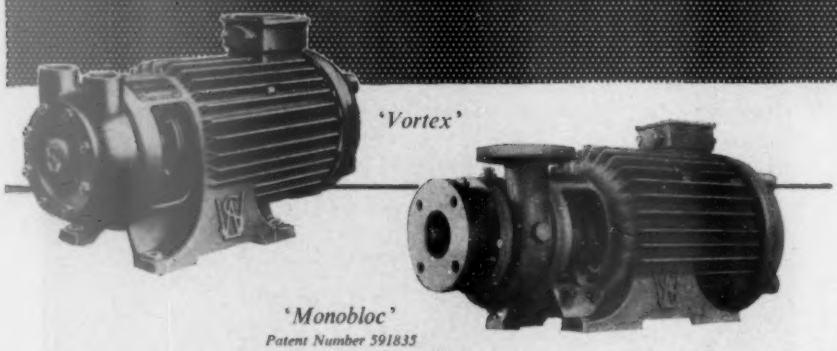
'Monobloc' centrifugal pumps of compact design, providing easy installation and perfect alignment and handling a wide variety of chemicals.

'Vortex' self-priming centrifugal pumps—providing the easiest and most economical method of small capacity pumping to high heads.

Type 'L'

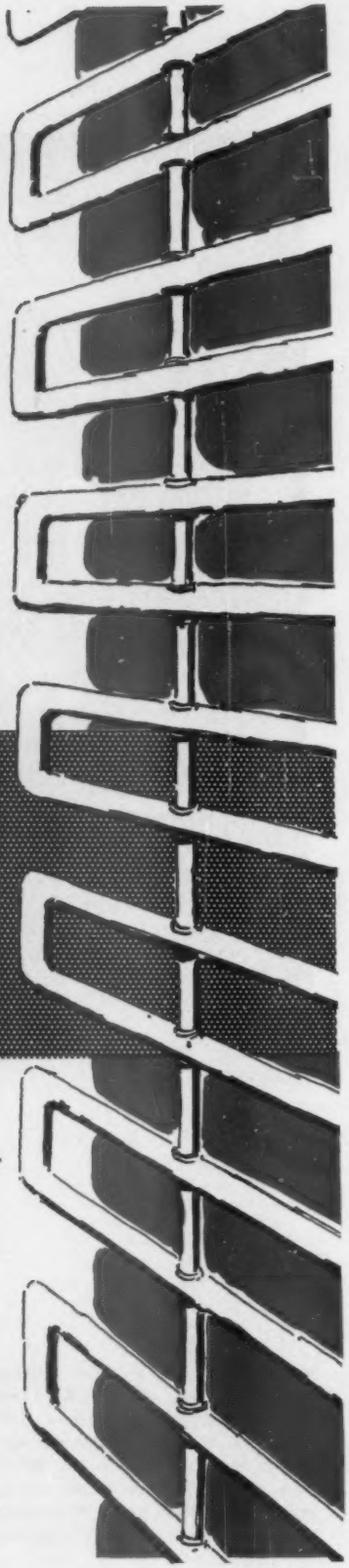


'Vortex'



'Monobloc'

Patent Number 591835



pumps for the refrigeration industry by

Worthington - Simpson Ltd

PUMPS • COMPRESSORS • HEAT EXCHANGE EQUIPMENT

NEWARK NOTTS

FRIGIDAIRE'S COLOURFUL STAND AT OLYMPIA

Further shots from 'Ideal Home'

FOOD FROM THIRTY REGIONS

A special display of food and prepared dishes, all of which originated within the Commonwealth and came from more than 30 regions, were shown in the "English Electric" 3.6 c.ft. refrigerator at this year's Ideal Home Exhibition; this refrigerator fits into a space of only 20 in. wide.

A Plant Environment Room at Oxford

PLANTS are clever ; they adjust their growth and development to the conditions which Nature provides. But man, too, is clever and, with the aid of modern science he is able to provide conditions of his own to control plant growth and development along the lines which he wishes.

Thus, in the laboratory, given a suitable degree of heat, light, air and humidity, plants will grow never suspecting they are not in their natural environment. Control of light and temperature can convince them that night has fallen or dawn has broken and they will behave accordingly.

Prestcold have equipped a number of plant environment rooms for various research establishments throughout Great Britain. A notable example is the one installed by the Southern Electricity Board, Oxford, for Professor C. D. Darlington in the Botany School, Oxford University.

In the insulated chamber, 14 ft. by 17 ft. by 6½ ft., the temperature can be maintained at any point from 32° to 86° F. The equipment consists of two Prestcold 1-h.p. Super Presmetic condensing units operating through air coolers, and this working in conjunction with two heaters maintains the thermostatically controlled temperature. Artificial daylight is provided by 60 5-ft. fluorescent lamps of 80 watts. With this equipment, time switches and thermostats enable a constant temperature to be maintained throughout a day and night cycle of given length. Thus within limits the temperature range and light intensity can simulate any environment for as long as is desired.

There are three principal uses for the Oxford environment room. At the time of writing it was being used to grow plants which would not normally be capable of growing during the winter.

Researchers will find the room suitable for growing plants under set conditions free from any unpredictable effects which a natural environment might have upon them. For instance, when a plant has been subjected to certain treatments and then grown in the environment room, research workers will be reasonably certain that any peculiarities resultant in the plant will have been caused by that treatment and by no other external effects. Disease-bearing organisms, large fluctuations in temperature and humidity, peculiarities of the soil and air-pollution, are some of the factors which could affect a plant grown in the open.

The third use for the room is to study plants grown in conditions which they would be unlikely to encounter in nature. Thus one component factor of the environment can be varied while the other conditions remain constant. Some research is being carried out on the effects on leaf surfaces of progressive reduction of light intensity while the temperature remains constant. Work is also in progress on the effect of temperature on the fertility of flowers. Such research would have been very difficult or impossible without a controlled environment room.

LATEST FRIGIDAIRE 14 c.ft.

Seen at the Milan Fair last month, this new 1959 Frigidaire 14.2-c.ft. "frost-proof" refrigerator-freezer has many exclusive features. There is no defrosting, not even in the freezer section, because frost never forms. Delicate lacework styling on door and base panels lends distinctive feminine touch. Storage facilities are scientifically designed, arranged and sectionalized to eliminate searching, stretching and bending. Refrigerator shelves and freezer baskets roll out. Built-in ejector and storage bin in freezer door assure bountiful supply of ice cubes on instant notice.

SECONDARY SURFACE HEAT EXCHANGERS

By A. G. LENFESTEY, B.A.*

During recent years, secondary surface plate-and-corrugation heat exchangers have been used on a number of low temperature plants, for which they offer several advantages over the traditional tubular types. The purpose of this paper is to provide a general description of the methods of construction and to outline some of the special features and limitations.

Introduction

The use of secondary surface plate-and-corrugation heat exchangers has long been established for aircraft applications for which their compact form and low weight are ideally suited.

Process developments have led on the one hand to inert atmosphere furnace-brazing of copper, nickel, steel, titanium and various non-ferrous alloys, and, on the other hand, to flux dip-brazing of aluminium alloys.

The combination of the plate-and-corrugation construction and the dip-brazing process has resulted in an extremely adaptable design basis for high efficiency, compact heat exchangers.

These are particularly well suited to low temperature applications, not only for their performance and compactness, but also for their low heat capacity and for the excellent ductility and increasing strength of aluminium alloys at sub-atmospheric temperatures.

For the aluminium units, the main parts are normally formed from Al. – 1.2 per cent. Mn. Alloy (I.C.I. Kynal PA 19, equivalent to BS 1470/NS 3) or from high purity aluminium when required on operational considerations. The brazing material is Al. – 7.5 per cent. Si Alloy, which is introduced as a coating.

Flow Patterns

There are two basic methods by which a number of elements may be built up to provide either a cross-flow or a contra-flow unit.

Either of these arrangements may be further developed to produce multi-pass or multi-stream configurations by including suitable internal seals and distributors and external header tanks.

The simple cross-flow layout is generally suitable for low to moderate duties.

For many low temperature applications, a very close temperature approach relative to the overall temperature range is required, and in such cases contra-flow units are generally provided. Headering arrangements must be matched to the type of duty involved.

* Marston Excelsior Ltd., Wolverhampton. Excerpts from a paper before the Low Temperature Group of the Physical Society, December 9, 1958.

Corrugations

With any arrangement, the corrugations may also be varied. A comprehensive range has been developed to cater for widely differing requirements, and includes plain, straight-through passages, pierced " multi-entry " passages, and continuously waved " herringbone " passages.

For standard industrial applications, heights vary between 0.15 in. and 0.464 in., thicknesses between 0.008 in. and 0.015 in. and fin pitching from 10 to 15 or 18 fins per inch. Surface areas range from about 300 to 450 sq. ft. per cubic foot block volume, and free-flow areas from about 0.75 to 0.80 sq. ft. per square foot cross-section. Each of these may be apportioned between the various streams to suit requirements. In general the 0.15 in. or 0.25 in. high corrugations are used for liquid or condensing streams, and the taller corrugations for gas streams, though there are exceptions. The " multi-entry " and " herringbone " patterns give enhanced heat transfer characteristics and are particularly attractive for applications involving close temperature approaches (i.e. characteristically long units).

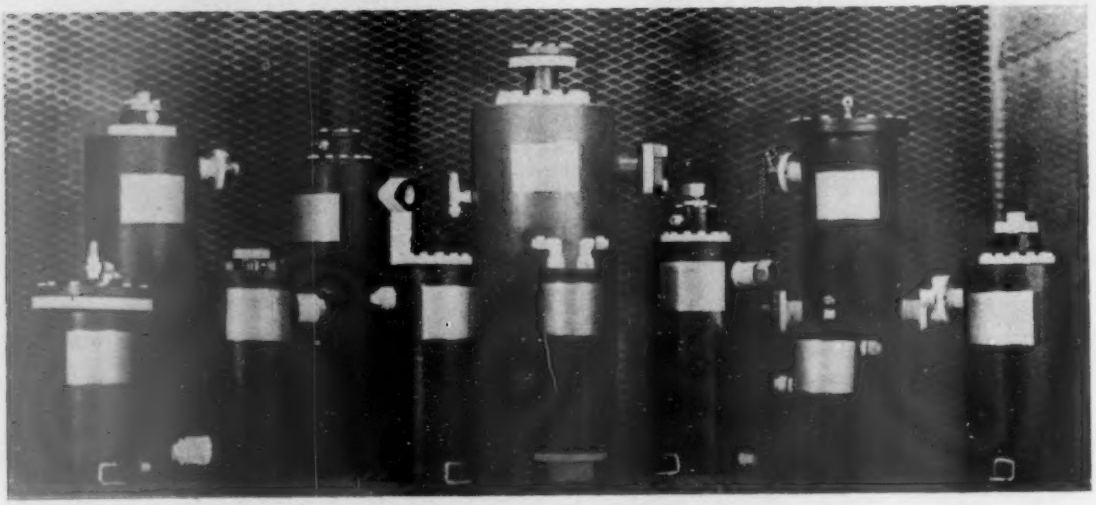
Pressure Limitations

For low to medium steady operating pressures, say, 50 to 100 p.s.i.g., the block layout and headering arrangements can be determined primarily on performance and installation considerations, and in general no undue mechanical problems are encountered.

The strength of the corrugations and associated brazed joints obviously dictates the maximum pressure to which this type of construction may be subjected. Depending upon their type and thickness the aluminium corrugations are generally satisfactory for static test pressures in the range 600 to 1,000 p.s.i.g. For low temperature applications the corresponding rated maximum operating pressures would be in the range 250 to 450 p.s.i.g. for steady conditions and 125 to 225 p.s.i.g. for reversing applications. Typical test units have been pressure cycled at room temperature between 0 and 150 p.s.i.g. and have withstood over 1,000,000 reversals without failure. Static test samples have been taken up to 1,800 p.s.i.g.

I.F. Eyles

A FEW SMALL SEPARATORS FROM OUR EXTENSIVE RANGE



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OVER 200 TYPES IN STANDARD PRODUCTION
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"SPECIALS" PRODUCED IN 24 HOURS
FOR USE WITH ALL REFRIGERANTS

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IIR NEWS

REVIEW OF NO. 1, VOLUME 39, 1959, OF "THE BULLETIN"

By Dr. EZER GRIFFITHS, F.R.S.

A NOTEWORTHY feature of this number of *The Bulletin* is a general survey of refrigeration activities in various countries which was made in 1958, and which is in the form of statistical information.

The data are given under the headings : Refrigeration machinery ; Household refrigerators ; Cold stores and ice-making plants ; Food refrigerating installations embracing meat, dairy products, eggs, poultry, fruits, vegetables, fish and sea products ; Applications of refrigeration excluding foodstuffs, biological and medical applications.

As regards forthcoming meetings and congresses we learn that the fifth symposium " on foreign substances in foodstuffs : effect of physical preservative agents on the quality of foodstuffs " will be held at the Academy of Sciences in Budapest this month. The 16th International Veterinary Congress will take place in Madrid. The fourth International Congress on Food Distribution will be held in Lausanne. The annual meetings of the International Dairy Federation will take place in London.

The first Argentine Congress of Refrigeration will be held in Buenos Aires. The programme covers a wide field of activities.

The Division of Food Preservation, Australia, has supplied a detailed list of items on its research programme. Canada, Great Britain, Norway and the U.S.A. have also given some information as to their programmes of work.

Turning now to the various abstracts in *The Bulletin*, several deal with temperature measurement. One describes a germanium resistance thermometer of the size of a common pin for which high sensitivity and stability are claimed in the temperature range near absolute zero.

Under the heading " heat transmission," we find abstracts of papers on such topics as an approximate method for the solution of the problems of heat transfer in the steady state : cases considered are the heat flow in insulated sections, with fins and ribs.

A paper from the Royal Institute of Technology, Stockholm, describes heat flow meters and their use.

Papers dealing with the production and distribution of cold survey such topics as " Modern controlling and measuring devices for refrigeration," " Measurement of ammonia flow rates," " Nomogram for determining superheating in the suction line," " Diagram for F.142."

Several abstracts are devoted to rotary and turbo-compressors, also to heat exchangers.

Three abstracts are of papers concerned with thermal insulation, one on surfacings for glass fibre and foam thermal insulation another on vapour problems in thermal insulation.

A paper from the U.S.S.R. discusses typical designs of refrigerated distributing stores. Use has been made of standardized structural elements and of typified plans and production plants.

Numerous abstracts deal with air-conditioning and they range over factors characterizing comfort, selection of the right air-conditioning system for multi-storey buildings, control apparatus, and air-conditioning in coal pits.

Pre-cooling and refrigerated transport by rail is the subject of a lengthy abstract.

Under the heading " Containers : packing " are abstracts of papers relating to the testing of small containers for transport of frozen food, etc.

The abstracts under the heading " The gas liquefying industry " deal with a combined hydrogen-helium liquefier, apparatus for the separation of argon and the technique of low temperatures.

There is an abstract of a lengthy paper on " Refrigeration in chemical engineering."

Under the heading " Fruit " there are abstracts on the " Cold storage of apples and pears grown in Morocco," an extended one with the title " New observations on the cooling of Passe-Crassane pears."

Abstracts relating to animals and animal products include one on " Thaw rigor and cell rupture " ; another on " Survival of rabbit ova stored at −79° C." and several on bovine semen.

One abstract deals with " The effect of various freezing methods on quality of poultry meat." No significant effect could be ascribed to the method of freezing.

At Purdue University, U.S.A., the effect of refrigerant gases on eggs for a period of 24 hours has been investigated and interesting information obtained.

Ten of the abstracts relate to dairy products some of the titles are " Observations on bacterial counts of farm bulk-cooled milk," " Payment for milk in proportion to its bacteriological quality," " Studies on the freezing of milk at low temperatures," " Cold evaporation for drying milk," " Experiments on the freezing and thawing of butter."

A lengthy abstract deals with freezing aboard in Japan. The Japanese recommend thawing the fish before cooking.

Tests on the freezing of sardines and on the processing of frozen sardines are discussed in one of the abstracts, another deals with frozen storage of plaice for subsequent thawing and filleting.

Ice cream is the subject matter of eight of the abstracts. An abstract entitled " Wholesale ice cream novelty production " states that a factory in the U.S.A. has a projected annual capacity of 75,000,000 units of 21 different ice cream novelty products.

There is an abstract of a lengthy paper dealing with deep-frozen products in Scandinavia, fish being the main topic, but one abstract is found under the heading " Regulations and standards," and that deals with technical and sanitary regulations for the manufacture and sale of ice-creams (Spain).

In the section of *The Bulletin* dealing with new publications received in the Institute's library the following are mentioned : Yearbook of Fishery Statistics, 1957, The Fruit Annual, 1959, a book on refrigerating technique published in the Netherlands and one on air-conditioning and refrigeration published in the U.S.A. Summer air-conditioning is the title of another book from the U.S.A.

A catalogue of Japanese refrigerating equipment, 1958, of 300 pages, has been issued in Japanese.

An English edition of the Russian work on " Semi-conductor Thermoelements and Thermoelectric Cooling " has been issued.

At a price of 7.50 dollars a complete bound set of Air-conditioning and Refrigeration Institute Standards can be purchased.

Most of the advertisements in *The Bulletin* are from French firms, there being only single adverts from England, Denmark, Italy and Switzerland.

The Faroe Islands are a group of 19 islands lying to the north-west of Scotland. The population is 31,500 spread over 18 inhabited islands, including 6,500 in Thorshavn which is the capital. The islands belong to Denmark, and before receiving a wide measure of home rule on April 1, 1948, were treated as an Amt or County of Denmark. The Faroese now have the right to negotiate their own trade agreements with foreign countries, but these are done through the concurrence of the Danish Government and usually form part of trade agreements between the Danish State and other countries who are importers of saltfish and klipfish such as Spain, Italy, Portugal, Greece and Brazil.

SOME SUBJECTS FOR DISCUSSION

At the 10th International Congress of Refrigeration a paper will be discussed dealing with experiments made over a period of several years in Denmark with radiation chilling of meat. The idea behind this method is that in effecting part of the chilling of carcases by irradiation, chilling can be carried out in a room without air-circulation. In this way shrinkage may be reduced considerably. The subject will be discussed by Mr. Korsgaard of the Sabroe Company, Aarhus, and Mr. Larsen of the Norproduct Company, Copenhagen.

Another interesting subject will be the use of thermoelectric cooling. Important papers will be presented by Professor Matts Bäckström, Sweden, by Professor E. B. Penrod, U.S.A., and by V. S. Martinovsky and V. A. Nager, U.S.S.R.

Further investigations regarding the possibilities of freezing slaughterwarm meat without prior chilling will be discussed by Professor Gustav Lorentzen, Norway.

Dr. J. C. Fidler, U.K., will present a review of the latest methods for the control of superficial scale in apples during cooler storage.

Freeze drying of foods is another field in which much development has taken place in recent years. A paper on this subject will be presented by Professor Tchigeov, U.S.S.R. Other contributions will describe the latest developments in the U.S.A. and U.K.

Film Showing

At the 10th International Congress of Refrigeration there will be a continuous film show. It is hoped that all participants who have access to films on refrigeration topics of general interest will notify the Secretariat (address : Refricongress, Postbox 57, Roskilde) or bring such films with them to the congress where arrangements for showing the films can be made. It is, of course, understood that no film which is purely a publicity film for a particular company can be shown.

AIRCRAFT FOR PRESSED STEEL'S TOP EXECUTIVES

Pressed Steel Company executives keep in touch by plane. Mr. H. R. Edwards (left) and Mr. M. A. H. Bellhouse, at Kidlington Aerodrome, near Oxford—on alighting from the D.H. "Dove" aircraft which has just been purchased by the Company for "top executive" use. On this occasion, they had been attending a Board Meeting in London and were on their way back to the Company's Cowley Headquarters; but the aircraft will also be used to provide a high-speed link between Cowley and the firm's other plants at Swindon, Glasgow and Swansea.

TO LINK FACTORIES IN OXFORD, SWINDON, READING, GLASGOW AND SWANSEA

ONE of the problems with which big industrial companies are increasingly faced is that of keeping in touch with a chain of factories that may be hundreds of miles away from one another. Visits to them can eat up—in travelling—hours, and days, of the time of top executives. On the other hand, if regular visits are not made, it is all too easy to lose the first-hand knowledge and the personal touch on which good management should be based.

The Pressed Steel Company is the latest to adopt the answer of maintaining its own, full-time "executive aeroplane." Though popular in America, this is a system which has still to be adopted to any great extent by industry in Great Britain. It has been said that the passenger miles flown by company communication aircraft in the United States now rivals, if not exceeds, the passenger mileage flown by civil airlines.

The Pressed Steel aircraft is a De Havilland 104 "Dove" 2B–G–AOFI, painted in the light and dark blue colour scheme which is standard P.S.C. "livery." Seating accommodation is provided for eight people, including the pilot. Radio and instrumentation are to airline standards thus enabling the aircraft to fly in most weather conditions. In addition, it can generally maintain radio contact in flight with the company's headquarters at Cowley.

Continued on page 491

BUYERS' GUIDE

Continued from page 488.

Communication Between Factories

The Cowley and Swindon plants of the car body division will be brought within two and a half hours door to door access of the Pressed Steel railway division's works at Linwood, Paisley, and the new £4,750,000 Prestcold plant at Swansea within one and a half hours of Cowley. Top management of the organization will be able to start their working day in one plant, spend most of the day in a distant factory and return to base in time to sign the mail which they may have dictated before departure. The European office, Pressed Steel S.A., at Brussels, will also be brought within reach of daily travel from the Cowley headquarters.

Airfield Facilities

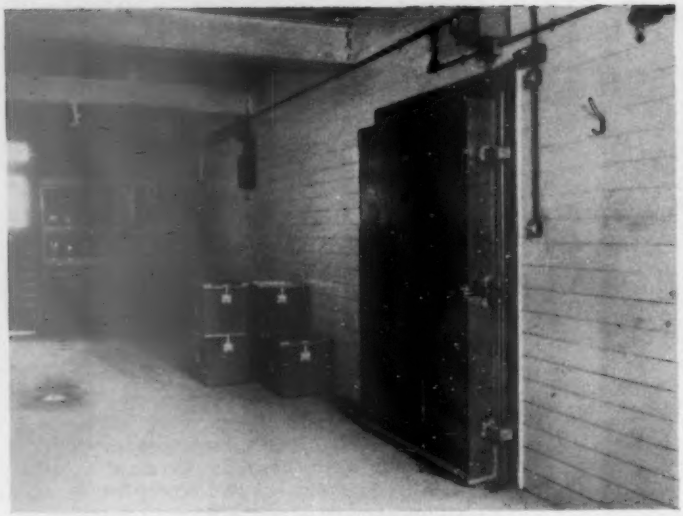
The Company is fortunate that the Oxford Municipal Airport is situated at Kidlington, a short car journey from Cowley and the Linwood Works enjoys the same proximity to Renfrew. Landing facilities have been made available at Swindon by the courtesy of Vickers-Armstrongs Ltd. Fairwood Airport at Swansea is available to complete the chain of landing grounds.

To estimate the possible place of air transport in the company's future activities, the operations of the Pressed Steel plane will for the first year be analysed in detail. Running costs will be checked against a close record of the actual saving of man-hours. An analysis will also be made of the air-travel requirements of the top executives of the different divisions of the company, so that a streamlined flight programme can be maintained.

Largest Cold Store Extends

Alford's Cold Store, Dallas, Texas, already a refrigeration giant, last month broke ground for a new warehouse in Corpus Christi that will serve thousands of square miles of fast-growing South and Coastal Texas. (*Alford's main plant has been described in these columns*). Work got underway for a million-dollar frozen foods storage and distribution centre in the semi-tropical city on the Gulf of Mexico—an area with a metropolitan population of some 300,000. Fred Alford, Jr. is president and general manager of the new firm which will operate the warehouse. It is Alford Refrigerated Warehouses of Corpus Christi. Alford retains his position as vice-president and assistant to the president of Alford Refrigerated Warehouses in Dallas, famed as " the world's largest refrigerator." Capacity of the Corpus Christi plant will be 1,100,000 c. ft. It will be 240 ft. wide and 350 ft. long—substantially bigger than a football field. Illustrating his faith in Corpus Christi's tremendous surge toward economic prowess, Alford brought out this point : " From the time initial plans were put together on the drawing boards until ground actually was broken, the size of the warehouse was boosted 50 per cent." At the age of 28, Alford already has had nearly two decades of experience in refrigerated storage and distribution. When only 10 years old he began doing odd jobs around the Dallas Alford warehouses, and he continued working while studying engineering and management at Southern Methodist University. He actually had a hand in construction of Alford's big Dallas facilities. A feature of the plant will be an Alford-patented, jet-blast freezer capable of processing up to 100,000 lb. a day. This capacity can be enlarged as the Coastal Bend food freezing industry develops.

GROUND BROKEN . . . Wielding shovels left to right, are Fred Alford, Jr., president of Alford Refrigerated Warehouses of Corpus Christi, Inc.; Fred Alford, Sr., president of Alford's in Dallas; Corpus Christi's Major Farrell Smith, and Corpus Christi Chamber of Commerce president Joe Wolff.



The coldroom entrance of Messrs. William Kingham & Sons with the Prestcold control panel on extreme left.

Frozen Food Store in Reading

The name of William Kingham & Sons, wholesale and provisions merchants and equipment suppliers, is very familiar in the grocery trade throughout the counties of Berkshire, Oxfordshire, Wiltshire and Hants. With depots in these four counties they provide a service to a great many retailers and they added to the facilities they offer when they recently completed a new frozen food store at Reading.

As the regional distributors for Regent Frozen Foods the store is primarily intended for this particular brand of frozen products and has a cubic capacity of approximately 7,650 c. ft. It is designed to hold 9 tons of frozen foods at a temperature of minus 15° F., a size which is expected to be of ample capacity to act as distribution centre for the Reading area.

The refrigeration equipment, which was supplied by the Southern Electricity Board of Reading, consists of four Prestcold three horsepower condensing units which operate four ceiling-mounted forced-air unit coolers. One of the interesting features about this equipment is that the Prestcold "Defrostermatic" automatic defrosting system is controlled by two time switches, which ensure that only two of the units defrost at a time so that the required temperature in the store is maintained throughout the whole operation.

The interior of Messrs. William Kingham & Sons Prestcold-equipped frozen food store at Reading.

THE COLLINS HELIUM CRYOSTAT

THE study of low-temperature phenomena in the region near absolute zero has long been hampered because laboratories have had to undergo the delay and expense of constructing their own gas liquefaction apparatus.

The Arthur D. Little, Inc. in the United States has recently developed a basic tool for cryogenic research, a machine for liquefying helium, called "The Collins helium cryostat." It is a self-contained, low-temperature refrigerator that can liquefy helium and can maintain any temperature down to -270° C. without auxiliary refrigerants.

Dr. S. C. Collins of the Massachusetts Institute of Technology worked out the prototype of the new unit. The present improved model was developed under the supervision of Dr. H. O. McMahon of Arthur D. Little, Inc.

The Collins helium cryostat liquefies gases at the following rates :

Helium	4 litres per hour if liquid nitrogen is used for precooling.
Hydrogen	4 litres per hour if liquid nitrogen is used for precooling.
	2 litres per hour without precooling.
Nitrogen	2 litres per hour without precooling.

The Collins helium cryostat uses helium for its refrigerant. The basic steps in the process of reducing helium to a liquid state, in this system, are :

(1) Compression.
(2) Removal of the heat of compression by cooling with city water.
(3) Thermal isolation of the cold end by the use of a gas-to-gas heat exchanger.
(4) Temperature differentials are produced by adiabatic expansion through engines at intermediate points in the heat exchanger system.
(5) At the cold end helium is liquefied by adiabatic expansion through a needle valve.

When the experimental chamber is to be used in the cryostat cabinet, the cycle is closed in the sense that the helium is continuously circulated around a closed circuit.

By imposing a thermostatically controlled heat load, or by operating at a pressure less than the normal 225 lb. per sq. in., the operator may maintain any temperature from room temperature down to -270° C. It is also possible to run experiments at temperatures below the lambda point of liquid helium, by building up a supply of liquid in the experimental chamber and then using the helium compressor as a vacuum pump to reduce the vapour pressure of the liquid.

Safe to use. Helium is the only circulating gas and the maximum pressure is only 225 lb. per sq. in., therefore explosion hazards are essentially eliminated.

This feature frees the research worker to concentrate on his experiments, rather than be concerned about the way the equipment is functioning.

Versatile : (1) The experimental chamber can be maintained at any temperature between 300° K. and 2° K. (2) Helium, hydrogen, nitrogen or other gases can be liquefied in a separate built-in circuit and removed for experiments remote from the cryostat. (3) The unit is entirely self-sufficient in the sense that it does not require any auxiliary refrigerant.

The vital part of the Collins helium cryostat is contained in the dewar. A 99 per cent efficient heat exchanger, in conjunction with two expansion engines and final free expansion, changes the entering helium gas to the liquid state.

Liquid helium can be removed through a draw-off tube which connects to the liquid helium reservoir at the bottom of the dewar.

Surrounding the outer wall of the dewar is an auxiliary liquefying coil that can be used to liquefy other gases, such as nitrogen or hydrogen. This liquefied gas can be removed through the same draw-off tube provided for the liquid helium.

The Thermo-electric Refrigerator

Products using new thermo-electric materials soon will be produced as cheaply as with traditional methods. Since any size container or cabinet can be refrigerated, it will be possible to break up the conventional refrigerator into individual drawers, closets and cabinets which can be located where required in the kitchen.

If the current's direction is reversed, heat instead of cold is created. This means that appliances of almost any size that both heat and cool can be devised.

A new dehumidifier employs the same principle to condense and capture moisture from the air. This particular unit is smaller than the compressor alone used in traditional dehumidifiers.

An ultrasonic dishwasher uses a device known as a transducer, which energizes the water with sound waves. These waves, invisible to the naked eye, attack and remove foreign particles attached to both metal and ceramic items.

The sectional refrigerator, using a conventional cold injection system, is styled as furniture and designed to divide the kitchen from the dining area. One section opens into both rooms so that foods and desserts can be served directly from it to the table. An optional five-foot section, that can be added on, is a home freezer.

Modern Practices for Drying Refrigerant Systems

TO the list of methods for dehydrating fluorocarbon refrigerants, a promising new tool has been added with the commercial availability of molecular sieves. Introduced during the last three years, molecular sieves are selective adsorbents of unusually high water capacity. Recent tests show that these materials may be used to dry refrigeration systems *after* assembly and that they can eliminate costly and time-consuming compressor drying operation.

The importance of eliminating essentially all water from fluorocarbon refrigerants in closed systems can scarcely be overstated. There had never been any question about the need for a dry system with some of the older refrigerants—sulphur dioxide, methyl, chloride, etc. Unless water was thoroughly removed from these materials, copper plating and corrosion rapidly deteriorated the refrigeration unit. At the same time, deposition of ice resulted in mechanical obstructions in small passages.

In fluorocarbon refrigerant systems, the harmful effect of traces of moisture is not quite so apparent, but it is real nevertheless. The problem is masked somewhat by the higher solubility of water in fluorocarbons and equipment manufacturers have become complacent about the thoroughness with which they dried refrigerant ; indeed some air-conditioning equipment has reportedly been charged with " Freon-22 " without any prior drying whatever.

During the last five years, the recognition has grown that the use of fluorocarbon refrigerants does not eliminate the need for thorough removal of water from the system. For example, refrigerant-22 will undergo hydrolysis in the course of time, and corrosion as well as copper plating will occur in due course if water has not been rigorously excluded. Even more objectionable is the trouble caused by deposition of ice crystals in the capillary tube or restrictor which have, of late, become widely adopted as expansion means. Formation of such an obstruction prevents the refrigerant from reaching the evaporator and, effectively, puts the refrigeration system out of action.

Conventional Methods of Water Removal

Several methods are to-day in use for eliminating water from refrigeration systems containing fluorocarbon refrigerants. Essentially all can be classed into two categories : (1) Drying by heat, vacuum, or purging ; and (2) drying by use of desiccants.

Among the first-named type of operation, the following are the most important methods used commercially for drying condensing units of refrigeration systems prior to assembly and charging with refrigerant :—

(*a*) *Heat and Vacuum Method.* The unit is placed into an oven at 275° to 300° F. for about 10 hours. During this period, a vacuum of about 150 to 250 microns is applied at the suction pipe leaving the oven.

An important aspect is the time needed to raise the unit to oven temperature (soaking time). Since convection currents in a high vacuum are almost negligible, conduction along the unit's metal parts is the only means available for raising the temperature. Heat-up in air—before applying vacuum—would result in shorter soaking time but it leads to corrosion.

Accordingly, the preferred method of speeding up heat-up is to introduce hot dry air into the system once or several times during the soaking period. The oven is then once again evacuated.

Still another way to reduce heat-up time is to introduce " Freon-11 " into the evacuated system. This fluid will evaporate on the external parts and condense on the internal parts of the unit being dried. In result, a very short soaking time becomes possible. The process is, however, quite costly due to incomplete " Freon " recovery. Typically, loss of " Freon " amounts to one pound per compressor.

In the case of some equipment types, it is possible to shorten the soaking time by applying resistance heating to the internal parts of the compressor. The method is not universally applicable; it requires close operating control, and is normally only economical when used for drying a very large number of identical compressors.

(*b*) *Dehydration by Dry Air.* A more modern method calls for circulating dry hot air (or nitrogen) through an oven containing the compressors which are to be dried. This approach can be made to yield the same degree of dryness as is achieved in the heat-and-vacuum method of dehydration. The system is particularly effective for large production runs. In such instances, it shows lower investment cost and operating costs which may underrun the heat-and-vacuum processes by as much as one dollar per unit of production.

Use of Chemical Desiccants

Chemical desiccants may be used by themselves or following one of the heat-drying methods described above. In this approach, refrigerant is

passed through a drier, essentially a cylindrical tank containing a fixed bed of chemical desiccant which is capable of decreasing the refrigerant's water content. The dried refrigerant is then circulated through the refrigerator unit being dehydrated. Here, residual water is dissolved in the refrigerant and is then once again circulated to the chemical driers.

Several types of chemical desiccant are used for drying fluorocarbon refrigerants. In general, the preference goes to activated silica or alumina or to calcium sulphate. Each of these materials has a high affinity for water and can be regenerated by heating. All of them are capable of reducing the water content of refrigerant to the extent required in commercial practice.

Different refrigerants exhibit different drying behaviour over a given chemical desiccant. Key distinction is the water content of each when it is saturated with water. Thus, " Freon-22 " at 80° F. and 100 per cent. relative humidity contains 1,350 parts per million moisture, while " Freon-12 " at the same conditions contains only 98 p.p.m. moisture. In the liquid phase, the distinction is even more pronounced ; the solubility of water in " Freon-22 " is 35 times greater than in " Freon-12 " (at 0° F.).

The permissible amount of moisture in a refrigerant is determined by one of two factors. In the case of low-temperature equipment, the controlling aspect is water-solubility at the evaporator temperature ; water solubility decreases as the temperature is lowered.

In the case of equipment operated above 32° F. (notably air conditioners), permissible water content in the refrigerant is set less by evaporator temperature than by corrosion and oil breakdown occasioned by the presence of moisture.

The water capacity of a chemical desiccant decreases sharply with the relative humidity of the refrigerant to be dried. For example, work by Ansul Chemical Company shows that, in drying " Freon-22" from the saturation point at 75° F., 22 per cent. of the desiccant is used up to reduce moisture content to 12 per cent. relative humidity or a water content of 150 p.p.m. Seventy-eight per cent. of the total load desiccant is taken up by decreasing the residual moisture to the safe value of 25 p.p.m.

It follows that more desiccant is needed to dry " Freon-22 " to safe moisture content than is called for in dehydrating " Freon-12. " For a safe moisture content (25 p.p.m.) corresponds to a 2 per cent. relative humidity in " Freon-22," while " Freon-12 " may have an R.H. of 10 per cent. for safe operation.

Use of Molecular Sieves

A wholly new type of drying agent for refrigerant are the so-called " molecular sieves." These materials are crystalline alumino-silicates. Their crystal structure contains pores of molecular size which can be carefully controlled so that only small molecules can enter the molecular sieve while larger molecules are rejected.

These materials have furthermore a strong affinity for polar molecules (such as water) which are small enough to enter the pores of the crystal structure. Using molecular sieves with a pore opening of 4 angstrom units (which are now commercially available), water may be removed almost quantitatively from fluorocarbon refrigerant. The refrigerant itself, as well as any contained oils, is made up of larger molecules which are physically unable to enter the pores of the molecular sieve crystal.

The result is a desiccant of very high water retention capacity. This capability to retain water is not influenced by the presence of hydrocarbon oils in the system. Finally, good water retention is observed even at fairly high temperature, a characteristic which distinguishes molecular sieves from chemical desiccants.

For example, in drying " Freon-22 " to a residual water content of 10 p.p.m., molecular sieves have a water capacity of 16 weight per cent. at 100° F. and 12 per cent. at 140° F. This is 5 to 10 times the water capacity of more conventional desiccants. Water capacity for " Freon-12 " at 10 p.p.m. is 18·3 wt. per cent. at 100° F.

Recent tests by the Linde Company show that molecular sieves are also satisfactory from the standpoint of mechanical operation in refrigerant drying service, *i.e.*, there was no serious attrition of the molecular sieve particles (except under severe vibration), and no significant compressor wear problem or pressure build-up in the system was observed due to installation of molecular sieve driers.

These properties suggest several ways in which molecular sieves can become an effective tool in drying fluorocarbon refrigerants systems. For example, they may be used *after* the refrigeration unit has been assembled, saving the cost of compressor drying. Another possibility is to place molecular sieves at various strategic points in the system (*e.g.*, close to the compressor). Still another advantage is the use of smaller drier cartridges than are possible with conventional desiccants. The result is a saving in both space requirements and cost.

Illustrated:
Model S6 . . . 6 ft. long

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ECONOMIC AND EFFICIENT PROTECTION FOR INSULATION

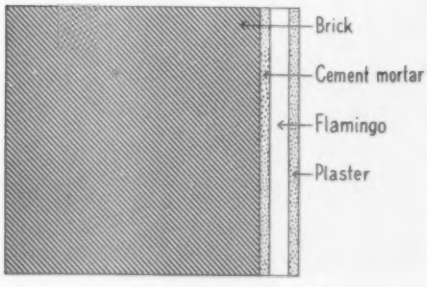
INDEX TO ADVERTISERS

F L A M I N G O

INSULATION BOARDS • PIPE SHELLS • BEADS • BUILDING STRIPS

Flamingo boards can be fixed directly to corrugated sheeting with Flamingo Ceiling Adhesive. For factory roofs especially, a fast and efficient insulation. Approx. price (including ½" Flamingo boards, adhesive and labour): 1 sh per sq. ft.

Brick wall insulation. Cement-lime mortar is applied to the wall as rough-casting — 24 hours later the Flamingo boards are coated with mortar and fixed. The plaster is applied directly to the Flamingo boards. — *An effective way to prevent condensation.*



A brick wall with ¼" Flamingo is far cheaper, occupies less floor space and insulates better than a cavity wall.

PRODUCT

A plastic foam with a closed-cell structure. The raw material, styrene, is polymerized and expanded into pearl-sized, air-filled beads, which are welded together to form extremely lightweight, impermeable boards. The finished product consists of 2 % polystyrene, 98 % air.

The material has a warm feel; it is snow-white, rigid, and can be supplied with either a rough or a smooth surface. Flamingo boards in thin thicknesses are flexible.

APPLICATIONS

A. building industry

With the rapidly rising cost of fuel, the passing of "The Thermal Insulation (Industrial Buildings) Act 1957", growing demands for greater comfort, and medical recommendations for insulated homes for better family health, proper insulation of new, as well as existing, buildings has become a "must" in Britain today.

An annual saving in fuel of 50 % is usual in a well-insulated house and will pay for the application of low-cost, speedily fixed Flamingo in two to three years.

walls and ceilings

Flamingo can be bonded to all building materials and is used to insulate all types of walls and ceilings.

Existing constructions. Because of its high insulating value, Flamingo is used to combat existing persistent condensation; it can be applied to external or internal surfaces and finished with plaster.

When a dry-finish is specified, plaster board or wall-lining with Flamingo Hard Surface Coat is recommended. When plaster board is specified, it can be fixed directly to Flamingo — a method that speeds construction, eliminates cavities behind the plaster board, reduces labour costs and does away with the need for wooden battens. For ceilings, plaster board and Flamingo can be fixed in one easy operation.

Building elements. Flamingo is easily embedded in concrete building elements. The material is used as an insulating core in lightweight curtain wall panels with outside skins of asbestos-cement board, reinforced polyester board, plywood or aluminium and inside skins of gypsum board, aluminium foil, or plaster.

Cavity walls. In new constructions Flamingo boards are fixed in cement mortar to the inner face of the wall or *Flamingo Beads* are poured into the cavity. In finished buildings the beads are blown into the cavity.

Cast-in-situ concrete constructions. In the construction of columns, walls, foundations, floor and roof slabs, Flamingo boards are placed in the shuttering before the concrete is poured and require no further fixing arrangements.

roofs

Corrugated roofs: Flamingo boards are fixed directly to the soffit of the corrugated sheeting. Concrete roofs: Flamingo boards are laid in hot bitumen directly on the concrete slab or on the rain-water screed, should this be required, and covered with roofing felt.

For external insulation of flat timber roofs, Flamingo boards are laid in hot bitumen and covered with two layers of roofing felt. For external insulation of pitched timber roofs, *F. T. Boards* are recommended. F. T. (Flamingo Tarpaper) Boards are made with a covering of roofing felt overlapping 4" at two adjacent sides; they are nailed to the roof and under ordinary conditions require no additional covering.

foundations and floors

Cold floors due to the absence of adequate insulation in the foundation can be prevented by fixing ¾" Flamingo boards to the inside of the foundation.

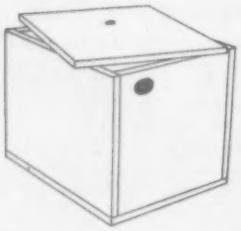
In the U.S.A. there is a growing tendency to insulate the perimeter as well as the foundation of build-

price list: pages 6-8

Horizontal as well as vertical perimeter insulation for greater thermal efficiency. Flamingo Offcuts are placed 1 yard wide along the perimeter before the concrete slab is poured. Approx. price per sq. yd. (incl. labour): 4 sh for 1"-layer. — Note use of Flamingo boards as inside shuttering for the concrete foundation.

Plaster is generally the finish of choice for walls and ceilings. The plaster can be applied directly as one-coat work, and finished with wallpaper or lining paper and paint.

Cold storage insulation. The unique water vapour resistance properties of Flamingo render it unsurpassed for low-temperature insulation. Building costs are considerably reduced because Flamingo is lower priced and only ⅔ of conventional thicknesses is required.



Flamingo tank lagging sets are easily fixed in adhesive and provide better insulation per unit of thickness than other insulants.

ings to ensure greater thermal efficiency. The ground is levelled and 4" of gravel spread out. A 1" layer of *Flamingo Offcuts* is laid along the perimeter one yard wide, and the concrete poured.

As base for parquet flooring instead of joists. Flamingo boards are laid in Flamingo Floor Bitumen directly on the structural floor and the parquet flooring is laid directly on the insulation.

As insulating cavity-filler (offcuts or granules) in floor construction where joists are specified.

Sound absorption and thermal insulation under vinyl, rubber, linoleum, quarry tile and terrazzo floors. The rigid Flamingo boards with 1½" sand/cement screed or 2 layers of hardboard are used to provide a firm base for the floor covering.

Flamingo insulating beads mixed with concrete provide low-cost sound and thermal insulation of heavy-traffic factory floors (in all cases with about ¼" topping of sand/cement).

general and miscellaneous applications

Insulation of flour silos, stables, poultry-houses, storage houses for root crops, etc., to preserve the insulating efficiency of the wall by preventing interior water vapour from escaping through the walls. ● Moist air inside buildings should never be allowed to escape through the walls but should be lead out through vents or ventilators.

Insulation against moisture and cold in summer cottages and on staircases; to counter condensation in damp garages, cellars and washhouses; to conserve heat in laundry drying rooms; thermal insulation of chimneys.

Insulation in steel plate constructions; to counter condensation on iron or steel mountings over windows and doors. To prevent heat losses in concrete buildings — for example, under the soffit of roof terraces.

As filling in laminated plywood boards and in external and internal doors; in hospital doors, often combined with a thin sheet of lead. As sound deadening in lift-shafts, under vibrating machines such as compressors, in pneumatic tube systems, etc.

In high densities (5 lbs. per cu. ft. or more) as support for columns and walls.

Flamingo Building Strips in lightweight concrete block construction. The strips are placed at the centre of each block, separating the mortar, and thus insulate against passage of cold and seepage of rain and moisture through the otherwise uninsulated joints. Use of the strips reduces the B.T.U. value of the wall by 10 %.

The strips are also used, with or without oakum filling on both sides, to prevent the excessive and too often neglected heat loss between window- and door-frames and the wall; and in expansion joints — for example, in the mounting of building elements.

Pipe shells for cold water mains and outside drains to prevent freezing or condensation, with consequent corrosion, dripping and peeling. Insulation of oil-piping in domestic and factory buildings as well as pipe lines. For pipe shells for hot water mains, *heat-resistant Flamingo* is recommended (the heat-resistant quality will resist temperatures up to 200°F.).

Tank lagging sets for the insulation of domestic cold water supply tanks in all standard sizes.

B. low-temperature insulation

Because of its remarkable water vapour resistance, Flamingo is ideal for low-temperature insulation. It is applied in refrigerated and freezer warehouses and lockers, food and beverage production plants, commercial and domestic refrigerators and freezers, walk-in coolers, and cold transport: water-coolers, ice-cream preservers, frozen food display cases, dry ice containers and beverage coolers.

Insulation of vessels and pipes for low-temperature liquids (brine, ammonia, etc.).

Pipe shells for low-temperature piping: in dairys, meat-packing plants, breweries and ships. Flamingo shells can generally be specified thinner than other insulating shells, with consequent lowered cost, and are so light that supports are usually unnecessary in fixing. Further advantages: cleanliness, ease and speed of fixing, and reduced wastage — up to 45 % less waste in the bends.

C. transport and packaging

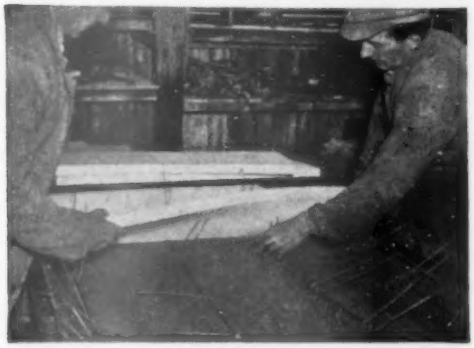
Shipping: Insulation of air-ducts, cabins and provision rooms as well as refrigerated holds. Special leaflet on insulation of ships supplied on request.

Refrigerated box-cars, vans and delivery vans for transport of dairy products, fruit, fish, etc.

Sound deadening and thermal insulation of coaches, trams and railway carriages; under the bonnet in motor cars to absorb engine noise.

Insulating packaging for the shipment and storage of dry ice, serum, vaccine, blood plasma and other biologics. Special packaging for glass ampoules.

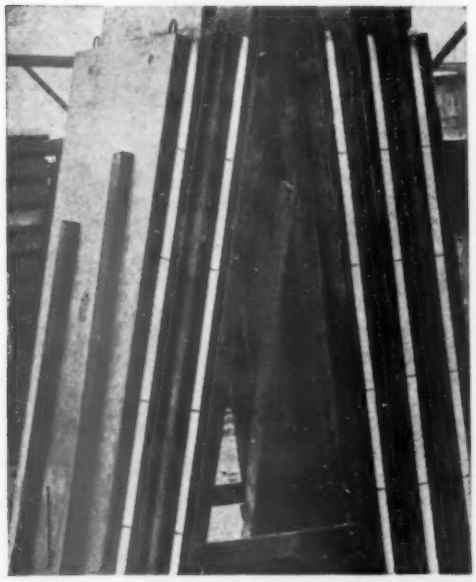
simple manufacture of concrete building elements:



Flamingo boards are laid in the form . . .

the concrete poured . . .

. . . and steel reinforcement placed on top.



Finished wall elements ready for mounting.

TECHNICAL PROPERTIES*

density

Green Label Flamingo, the waterproof, standard quality, has a density of	1.25 lb. per cu. ft.
Red Label Flamingo	0.95 lb. per cu. ft.
Black Label Flamingo	0.60 lb. per cu. ft.

Other densities supplied to specification.

mechanical properties

Compression strength	8 British tons per sq. yd.
Shear strength	70—80 lbs. per sq. in.
Bending compressive strength	50—60 lbs. per sq. in.

Flamingo is shatter-proof and does not disintegrate, dust or flake. Owing to its remarkable impact strength, Flamingo enters constructions as a self-supporting member, simplifying construction considerably.

thermal properties

Temperature range:	Minimum	no limit
	Maximum	180°F.
	Melting point	212°F.

(Maximum temperature for oil- and heat-resistant quality ..... 200°F.)
Co-efficient of linear expansion ..... 0.000022 per °F.
Thermal conductivity ..... 0.21 B.T.U./sq.ft./hr./°F./inch

B.T.U. values for selected constructions with Flamingo:

HEAT TRANSMISSION "U" B.T.U./sq.ft./hr./°F.

CONSTRUCTION	Thickness of Flamingo board in inches (applied to inner face) 0	½	1	1½	2	3	4
Type of Wall							
13½" brick wall	0.36	0.21	0.14	0.11	0.09	0.07	0.05
9" brick wall	0.45	0.23	0.16	0.12	0.10	0.07	0.05
4½" brick wall	0.57	0.27	0.17	0.13	0.10	0.07	0.05
11" cavity wall	0.31	0.19	0.14	0.11	0.09	0.06	0.05
9" lightweight concrete blocks (45 lbs./cu.ft.)	0.13	0.10	0.09	0.07	0.06	0.05	0.04
5" reinforced concrete	0.63	0.27	0.17	0.13	0.10	0.07	0.06
1" boarded wall	0.52	0.25	0.17	0.12	0.10	0.07	0.06
1½" breeze blocks	0.57	0.26	0.17	0.12	0.10	0.07	0.06
4" breeze blocks	0.34	0.20	0.14	0.11	0.09	0.06	0.05
T.S.K. Elements outside: asbestos-cement panel insulating core: Flamingo board inside: gypsum board	0.92	0.32	0.19	0.14	0.11	0.07	0.06
Type of Roof							
corrugated asbestos cement	1.11	0.36	0.22	0.16	0.12	0.09	0.07

The U-values given in the table are theoretical values based on laboratory tests under constant conditions. *They will, moreover, hold true in practical applications under widely varying conditions* as well, because Flamingo is a closed-cell material in itself waterproof, windproof and vapour resistant.

Non-cellular insulation materials absorb moisture, vapour and water and their insulation values are drastically reduced as they become waterlogged. U-values for non-cellular materials will generally not be maintained in construction unless expensive and elaborate wind and vapour barriers are built to protect them. Closed-cell Flamingo on the other hand provides its own barriers and will continue to insulate at the high theoretical values.

* The technical properties of the material vary with the density — the higher the density, the greater the strength. The charts record properties of standard quality Green Label Flamingo (1.25 lb. per cu. ft.).

water and vapour resistance

The closed-cell structure of Flamingo expanded polystyrene completely prevents absorption of water. The primary water resistance characteristics are listed below.

1. Capillarity: None.
2. Water adsorption: Water pick-up when completely submerged in water for six months — maximum 2 % of volume. In Flamingo this water is completely on the open surface cells.
3. Water vapour resistance factor: Over 100.

In determining the insulating value of a material, the water vapour resistance is of critical importance. For example, water absorption of 5 % of volume — usual for and generally exceeded by non-cellular materials — can reduce the insulating value of an insulant by more than 50 %.

● Flamingo has a water vapour resistance factor *three times greater* than that of any insulating material known today. Independent laboratory reports can be supplied on request.

Materials of densities lower than standard Green Label (1.25 lb. per cu. ft.) are not guaranteed waterproof.

sound insulation

The special structure of the material provides unusual sound deadening properties. Tests have shown that the sound transmission through a 5" concrete slab insulated with ⅜" Flamingo is reduced from 95 phon to 82 phon.

For acoustic insulation special sound-absorbing *Flamingo Ceiling Tiles* are recommended. These tiles, easily fixed in Flamingo Ceiling Adhesive, provide a decorative and efficient sound insulation at an extremely low cost. Case histories of acoustic insulation can be supplied on request.

fire characteristics

Standard quality Flamingo burns more or less like wood. In the majority of practical applications the material will melt down to 2 % of original volume before the flame reaches it.

Non-inflammable quality Flamingo is recommended for applications where fire-proof insulation is required — for example, in unprotected ceiling constructions and in ships. This quality material has been made self-extinguishing throughout by a special chemical process and is not merely surface impregnated with a fire-proofing agent. Non-inflammable Flamingo has been approved by Lloyd's Register for use in ship construction.

chemical resistance

Flamingo is stable in all alkalies, most acids, carbon dioxide, alcohol, ammonia, sea water, freon, fat, tallow and animal oils.

It is unstable in nitric acid, chlorides, turpentine, mineral oils, benzol, petrol, ether, acetone, and similar hydrocarbons.

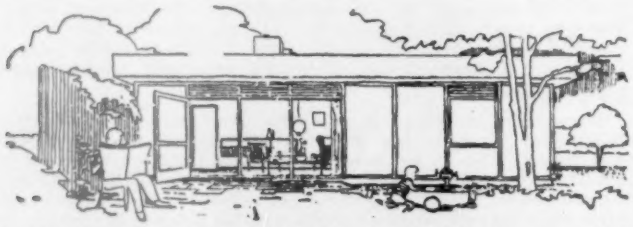
miscellaneous properties

Laboratory tests indicate that Flamingo can be expected to retain its properties and last indefinitely when protected from mechanical damage.

Flamingo is not subject to rot or decay. Wet or dry, it is absolutely odourless and does not give off fumes. It is inactive towards all foodstuffs and is incapable of supporting mould growth. The material is tasteless and contains nothing of food value; consequently it does not attract rodents or vermin.

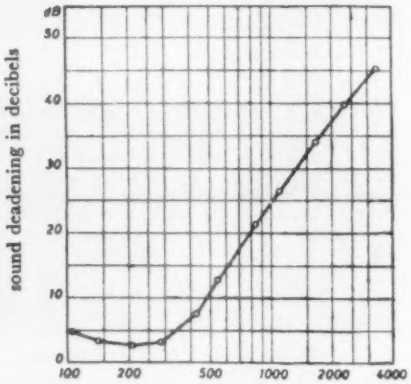
Flamingo is non-irritant and presents no health hazard in handling; it is, in fact, light, clean and pleasant to work with.

Flamingo has a buoyancy factor of 61 lbs. per cu. ft.



Architectural plans of Scandinavian low-cost model homes are supplied on request. The 120 sq. yds., centrally-heated, 3-bedroom Flamingo house is so efficiently insulated that it can be heated for £ 2 per month. Building time: 2 months. Building cost: £ 1500/-.

Flamingo cistern floats are absolutely waterproof — seamless, will not leak — non-metallic, will not corrode. The lower cost and the security against unnecessary future repairs make it worth while to specify new cisterns supplied with Flamingo floats. Accepted by: British Standards, B.W.A., M.W.B. and local water authorities.



Sound deadening graph shows the unusual sound insulation effect obtained in floor constructions with only ⅜" Flamingo board.

Sound and thermal insulation of floors is achieved by placing ½" Flamingo boards directly on the structural floor. 1½" cement screed (with optional chicken-wire reinforcement) is poured to form the base for the floor finish.

Parquet flooring. Flamingo boards are laid in Flamingo Floor Bitumen on the structural floor. The tongue-and-grooved parquet flooring is laid in Bitumen directly on the waterproof insulation. Building time is saved as there is no need to wait for concrete to dry out before laying the floor.

Wooden floors. In conventional construction, cavities between joists are filled with Flamingo Offcuts for thermal insulation. Standard boards can be laid under the joists for sound insulation.

Floor heating. Radiant heat piping is laid on Flamingo boards to prevent heat loss. Alternatively the boards can be placed under the structural floor, a construction used extensively in electrically-heated flooring.

Conventional curtain wall construction with Flamingo. Flamingo insulation provides lighter and thinner curtain walls, makes vapour-barrier and ventilation construction unnecessary, and reduces labour costs.

FIXING AND INSTALLATION

workability

Ordinary carpenters tools are generally used. The material is easily cut — kitchen shears or a saw-toothed bread knife can even be used.

The extremely light weight of the material and the clean sharp edges facilitate fixing considerably — especially in ceiling work.

Thin boards are flexible; thicker boards can be bent over a heated rod (thermostatically regulated).

fixing

Detailed fixing instructions for all general applications of Flamingo are available from the Company and will be supplied upon request. Before applying Flamingo, fixing instructions for the particular job should be obtained and carefully adhered to.

Flamingo boards can be fixed in cement mortar, gypsum, adhesive asphalt emulsions (Flamingo Asphalt Emulsion), hot bitumen, some ordinary cold water adhesives, or the special Flamingo Adhesives (which require no supports in fixing).

finishing

Nearly every finish can be applied directly to Flamingo boards.

Plaster can be applied directly onto rough surface panels with or without metal lathing or chicken-wire reinforcement. Wallpaper and aluminium foil may likewise be applied directly to the insulation. The boards can be painted with plastic paints without further preparation. If oil paints, lacquer, or finishes containing thinner or similar substances are to be used, the Flamingo boards should first be treated with lining or, better still, coated with Flamingo Hard Surface Coat.

economical flamingo constructions

Flamingo means economy in space. A change to Flamingo in a refrigerated cold storage room increased the floor area from 30 sq. yds. to 40 sq. yds. — an increase of 33 %. The floor area of a large block of flats was increased by 3 % of the original design (corresponding to the cupboard area) when the architect changed his specifications to thin curtain walls insulated with Flamingo.

● 4½" brick curtain walls can often be specifjed instead of standard 11" cavity walls. Flamingo is fixed to the inner face of the wall with cement mortar and plastered. A thinner wall (and larger floor area) and appreciably better insulation are obtained, often at a saving of up to 10 sh per sq. yd. of wall.

● Concrete constructions can be insulated in one easy operation by lining the shuttering (which need not be continuous) with Flamingo boards. When the concrete has set, the shuttering is removed, undamaged and unsoiled. The insulated wall can be plastered immediately, with or without metal lathing or chicken-wire reinforcement, despite the dampness of the concrete outer wall. With this Flamingo construction, concrete walls with a specified B.T.U. value are obtained and an insulating inner wall is not necessary.

In in-situ concrete constructions where no insulation is necessary but a speedy and economic construction is required, the shuttering is lined with cheap ¼" Flamingo boards and construction is carried out as above.

● Fewer and lighter supports are required with the lightweight Flamingo constructions. Lightweight laminated building elements can be placed without cranes.

● Sound insulation of flooring need no longer mean extra expense and special constructions for the builder. ½" Green Label Flamingo boards are laid directly on the structural floor, the joints sealed with tape and 1½" cement screed poured and levelled, forming the base for the floor finish. This Flamingo construction not only provides sound and thermal insulation but also a firm watertight base for the screed, providing ideal conditions for slow hardening and reducing the likelihood of later cracking.

● Parquet flooring laid directly on Flamingo boards is insulated against sound, cold and moisture and provides a comfortably elastic surface to walk on. A saving in wall height corresponding to one course of bricks is obtained with this floor construction — a saving that alone will, in an average home, often pay for the parquet flooring in one of the rooms.

● Pitched timber roofs covered with F. T. Boards can be insulated to a specified B. T. U. value and covered with roofing felt in one economical operation.

● Flat timber roofs can be insulated externally with Flamingo boards covered with two layers of roofing felt. For a decorative beam ceiling, the timber boards can be planed and bevelled: a separate ceiling construction is thereby omitted at a saving of more than 15 sh per sq. yd.

Lightweight T.S.K. Building Elements are so easy to assemble that they are often laminated at the construction site. For curtain walls, asbestos-cement panels are fixed to the outside; for soundproof office partition walls, gypsum boards are fixed to both sides of the insulating core.

The laminated T.S.K. Elements consisting of a 2" Flamingo core between asbestos-cement panels are used here in the construction of a movable partition wall in a cold storage room. Price per sq. ft. of element: approx. 3/3 d.

External insulation of walls. As Flamingo boards are resistant to all weather conditions they can be fixed to outside walls in cement mortar and plastered. Insulation can thus be achieved without disturbing the interior of the building.

Thermal insulation of cavity walls in existing buildings with Flamingo Beads. An average home can be insulated in one day. A blower may be borrowed from the Company, and all work is done from the outside, avoiding any disturbance of the interior of the home.

Insulation behind radiators. As on walls and ceilings, the Flamingo boards are fixed in adhesive or cement mortar.

Cupboards and bookcases facing outer walls can be insulated against dampness with Flamingo.

ORDERING

type	quality mark	properties
Boards	Green Label Flamingo	Waterproof, 1.25 lb. per cu. ft.
Boards	Red Label Flamingo	0.95 lb. per cu. ft.
Boards	Black Label Flamingo	0.60 lb. per cu. ft.
Oil- and heat-resistant boards	Oil- and heat-resistant 200°F.	Resistant to mineral oils and petrol and usable in temperatures up to 200°F.
Marine boards	Non-inflammable Green Label Flamingo	Waterproof, 1.25 lb. per cu. ft., non-inflammable
Offcuts	Flamingo Offcuts	Thin uneven cuttings
Insulating beads	Flamingo Beads	Waterproof, featherlight, pearl-sized beads
Acoustic tiles	Flamingo Ceiling Tiles	Special quality sound-absorbing, non-inflammable bevelled tiles
Insulating stripping	Flamingo Building Strips	Green Label Flamingo supplied by the yard in stripping generally 1½" wide and ⅜" thick

Apart from the commonly supplied types listed above, the material can be supplied in any density, to order. The Company does not recommend qualities lighter than 1.25 lb. per cu. ft. (Green Label Flamingo) as these cannot be guaranteed waterproof.

Pipe shells in Green Label Flamingo and oil-resistant Green Label Flamingo. *Flamingo cistern floats,* models to fit all standard cisterns. *Flamingo tank lagging sets,* to fit all BSS. models. ***Moulded items:*** special packaging, decorative items, moulded covers for ice-cream preservers, etc., moulded to order.

dimensions

Standard board sizes: 3 ft. × 6 ft. / 3 ft. × 3 ft. — thicknesses: from ⅜" to 14"
2 ft. × 3 ft. — thicknesses: from ¼" to 14"

The larger boards are usually recommended as they are easiest to fix, give less waste and offer up to 10 % better insulation due to fewer joints. Special size boards are made to order.

All Flamingo boards are supplied with clean, sharp edges and with surfaces either rough (for plastering) or smooth (for gluing).

Please specify size, thickness and surface when ordering.

Pipe shells are supplied in all dimensions and thicknesses according to specifications.

prices as per April 1959:

a. boards in standard sizes **

Board thickness (in inches)	Price per sq. ft.		Board thickness (in inches)	Price per sq. ft.	
	Green Label quality (1.25 lb./cu.ft.) Waterproof	Red Label quality (0.95 lb./cu.ft.)		Green Label quality (1.25 lb./cu.ft.) Waterproof	Red Label quality (0.95 lb./cu.ft.)
¼"	3¾ d.	3¼ d.	1½"	1/6 d.	1/2 d.
⅜	5¼	4½	1¾	1/8½	1/4½
½	6½	5½	2	1/11½	1/6¾
⅝	8	6½	2½	2/5	1/11
¾	9½	7½	3	2/11	2/3½
1	1/-	9¼	4	3/10	3/1
1¼	1/3	11¾	5	5/7	4/7

All thicknesses in the range ¼" to 18" supplied: Prices on application.

Black Label quality (0.60 lb. per cu. ft.) ..... Green Label prices less 33⅓ %
Oil-resistant Green Label quality ..... Green Label prices plus 25 %
Non-inflammable quality (Green Label and higher densities) . Above prices plus 15 %

** Prices for orders of less than 1500 sq. ft. on application.

b. flamingo offcuts for attic and perimeter insulation

Price per yard cube: 130/- — e.g., 1"-layer: 5 d. per square foot

c. flamingo beads for cavity insulation

Price per yard cube: 120/-
(Price blown-in: 8/- to 10/- per yard square of wall surface)

Flamingo Granules also available, price per yard cube: 95/-
(Price blown-in: 6/6 to 8/6 per yard square of wall surface)

d. flamingo ceiling tiles

Sizes: 18" × 18", 16" × 24", or to specification

½" thick ..... 10¼ d. per square foot
¾" thick (for suspended ceilings) ... 11¾ d. per square foot

1½" × 1¼" Flamingo battens for suspended acoustic tile ceilings, approx. price: 1½ d. per square foot of ceiling.

e. flamingo building strips

⅜" thick and 1½" wide ..... 2½ d. per yard run
All other dimensions ..... Per quotation

f. pipe shells

Green Label quality (maximum temperature 180°F.)

Pipe diameter (in inches)	Inner diameter of shell (in inches)	Price per foot run of insulation			
		Thickness of shell (in inches)			
		¾	1	1½	2
½"	15/16"	1/3 d.	1/6 d.	2/8 d.	3/8 d.
¾	1⅛	1/6	1/7	2/9	3/10
1	1⅜	1/9	1/11	2/11	4/6
1¼	1 11/16	2/2	2/4	3/6	4/9
1½	2	2/4	2/7	3/10	5/4
1¾	2¼	2/6	2/8	4/–	5/5
2	2 7/16	2/9	2/11	4/5	5/7
3	3⅝	3/6	3/8	5/7	7/1
12	12½	11/5	11/8	16/6	20/2

All dimensions and thicknesses supplied to specification: Prices on application.

Pipe shells in *oil- and heat-resistant* quality: Above prices plus 25 %

g. flamingo cistern float

Price per float: 2/3

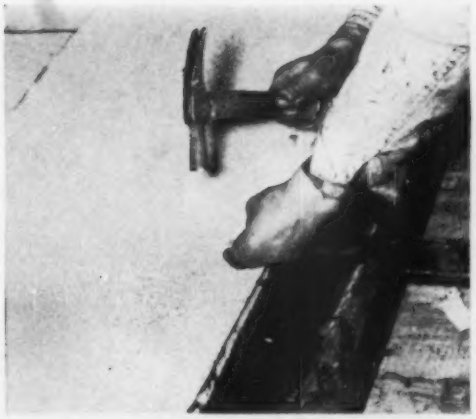
h. tank lagging sets

Sets supplied to fit the whole of the BSS. range. Specify BSS. size number or give dimensions. Prices include sufficient quantity of Flamingo Adhesive for fixing.

BSS. Size no.	Dimensions (Length, width, height)	Price per set
C 5 C 6 C 7	2' × 1'6" × 1'7" 2'3" × 1'8" × 1'8" 2' × 2' × 1'7"	½" board: 36/– d. ¾" board: 47/–
C 8	2'5" × 1'10" × 1'10"	½" board: 45/6 ¾" board: 60/6
C 9 C 10 C 11	2'6" × 1'11" × 2' 2'8" × 2'2" × 2' 3' × 2' × 1'11"	½" board: 51/– ¾" board: 68/–
C 12	3' × 2'2" × 2'	½" board: 62/6 ¾" board: 81/6
C 13 C 14	3'2" × 2'3" × 2'3" 4' × 2' × 2'	½" board: 69/– ¾" board: 90/–

i. fixing materials

The Company carries on stock at current prices large-headed galvanized nails, impregnated wooden nails, sealing tape, and, as well, odourless Flamingo Asphalt Emulsion and Flamingo Hot Bitumen for fixing



External roof insulation with F.T. (Flamingo Tarpaper) Boards. F.T. Boards are simply nailed to the pitched timber roof and the overlapping ends sealed. See text for construction examples for flat roof insulation.

Insulated cast-in-situ concrete deck. Flamingo boards are laid on the shuttering, steel reinforcement is placed on top and the concrete poured.

Insulated foundations are just as important as insulated walls. In brick foundations the boards are fixed to the inner face with cement mortar. In existing constructions, a trench is dug and boards are placed against the outer wall.

"Wallpapering" with Flamingo — prevents condensation, and radiation of cold, and saves fuel. The walls actually *feel* warm with Flamingo boards, and the Hard Surface Coat provides a smooth and even wall surface. Maximum insulation is obtained by the use of boards in floor panel thickness less 1/16" allowance for Hard Surface Coat. The cost of Flamingo Adhesive and Hard Surface Coat is approximately 4¼ d. per sq. ft. — **NOTE:** Flamingo board avoids the use of wooden battens, aluminium or bituminous water vapour barrier and the removal of skirting and door beading. Just follow the easy fixing instructions — supplied upon request.

Flamingo boards in cold storage rooms (approx. requirements: 2 lbs. per sq. yd.). The Company also supplies:

Flamingo Adhesive, white, for "wallpapering" with Flamingo: approx. req.: 1 gallon per 150 sq. ft.	½ gal. tin:	per tin 15/6 d.
	1 gal. tin:	per tin 29/6
Flamingo Ceiling Adhesive, for insulation of roofs and acoustic insulation of ceilings: approx. req.: 1 gallon per 120 sq. ft. (corrugated roofs: 1 gal./250 sq. ft.)	5 gal. drum:	per gal. 28/6
	10 gal. drum:	per gal. 27/11
Flamingo Hard Surface Coat, grey, for "wallpapering" with Flamingo: approx. req.: 1 lb. per 3 sq. ft.		per 56 lbs.: 35/-
		per cwt.: 65/-
Flamingo Plaster Additive used by the building trade for "wallpapering" with Flamingo: approx. req.: 1 gal./170 sq. ft. for fixing, 1 gal./60 sq. ft. for finishing		per 1 gal. tin: 9/6 d.
Flamingo Floor Bitumen, black, for parquet flooring: approx. req.: 1 lb. per 5 sq. ft.		per 44 lbs.: 30/–

delivery & quality marking

Delivery: Usually from stock. *Stockists:* Send for list of local stockists. Each board of waterproof Green Label Flamingo is stamped on the edge with a Green Label quality mark. Check that the right quality has been shipped upon receipt of the order.

REFERENCES AND SERVICE

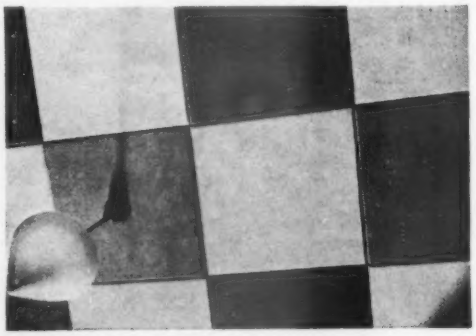
Recommended by leading architects, building contractors, and engineers for all types of building construction as well as low-temperature insulation. In general use in large building blocks, factories and housing. Specified by leading manufacturers for insulating refrigerated cars and vans, buses and commercial vehicles.
Detailed technical information available from London office. Finished projects as well as buildings under construction shown upon appointment.

Leaflets available on:

- "Wallpapering" with Flamingo boards — Building trade or "Do it yourself" specifications
- Fixing of Flamingo Ceiling Tiles
- Application of Flamingo directly to corrugated sheeting
- Application of Flamingo in mortar with subsequent plastering
- Applications and fixing instructions for Flamingo in low-temperature insulation
- Flamingo Bead insulation of cavity walls
- Insulation of ships
- Architectural plans of low-cost Flamingo-insulated one-family homes
- Independent laboratory reports on technical properties

Without charge or obligation our architectural and engineering staff will be pleased to suggest new insulation and construction methods upon receipt of sketches or drawings of the proposed project.

Flamingo pipe shells for insulation of domestic and industrial piping reduce the labour costs to a fraction of former expense. Unsurpassed for the insulation of low-temperature piping.



Flamingo Ceiling Tiles provide thermal as well as acoustic insulation at the low cost of 10 d. per sq. ft. Ideal for offices, shops, work rooms, kitchens, children's rooms — and for repairing old ceilings cracked or stained from condensation.

FLAMINGO FOAM LTD.

London office:
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London warehouse:
43/65 Penberth Road, Catford, S.E.6

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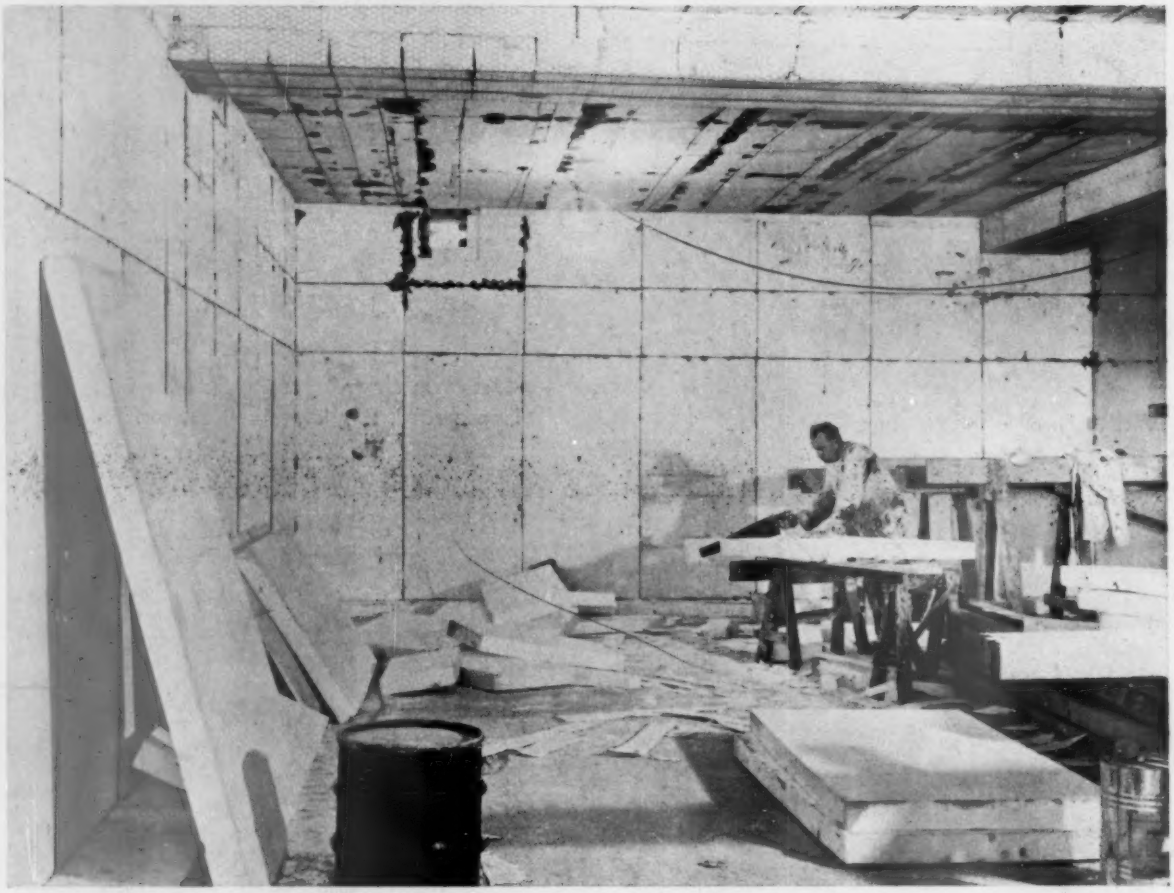
BUILDING OR EXPANDING A COLD STORE ?



Send a sketch or drawing of the proposed cold storage to Flamingo. Our engineering and architectural staff will return it to you with construction and insulation suggestions—with prices—at no obligation to you.

By insulating with light weight (98% air), closed cell, snow white Flamingo board you save money (Flamingo is cheaper per cubic foot) and space (2" Flamingo corresponds in insulating value to 3" ordinary insulants).

But most important, you get a more durable insulation, due to Flamingo's high water vapour resistance.

Have you checked the pipe-lagging in your cold store recently ? Is it still dry and efficient ? Make the repairs with Flamingo waterproof pipe-shells, supplied in any thickness and in sizes to fit all pipes.

Write for samples to :

FLAMINGO FOAM LTD

34 Victoria Street, London, S.W.1 ABBey 1543

OVER 600 REFRIGERATED ROOMS AND COLD STORES HAVE BEEN INSULATED WITH FLAMINGO FOAM—WITHOUT A SINGLE COMPLAINT

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